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RESULTS OF RADIATION THERAPY IN 1,022 PRIVATE CASES OF CARCINOMA OF THE BREAST FROM 1902 TO 1928*

(INCLUDING 127 CASES IN WHICH RADIUM AND ROENTGEN RAYS WERE COMBINED)

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WE, AS radiologists, are convinced that radiation therapy is of definite value in carcinoma of the breast, but a mere opinion is not sufficient for others. Some careful and conscientious surgeons, who realize fully the importance of skill and clinical judgment in the use of surgical instruments, fail to appreciate that similar skill and clinical judgment must be used with both radium and the roentgen rays in order to obtain good results. Dependence upon the magic of the radiation agents themselves rather than upon their skillful application is the probable explanation of certain poor results and is the cause of the skepticism that follows.

This study is based upon a review of 1,022 cases treated in my private clinic up to 1928. The statistics have been collected by my associate, Dr. Leo D. Parry. The hospital cases have not been included because, until recently, it has been impractical to follow up a sufficient number to make their inclusion of any value. None of these cases were treated by radium alone, and only a small proportion received any radium treatment. Radium is, in my opinion, relatively more powerful for its local effects on cancer than the roentgen rays, but for deep effects or wide distribution it is of less value unless used in very large quantities and at a distance. Mr. Sampson Handley believes that breast cancer, when it comes to operation, is already an intrathoracic disease, and the rational treatment seems to be to irradiate the chest more thoroughly, with special attention to the lymphatic areas. The first course of treatment should always be as thorough and vigorous as possible, for there is no doubt that recurrences appearing after prophylactic irradiation are highly refractory to further irradiation. Since cancer of the breast is so generally a widely distributed disease, we use the radium for intensive local effect and the roentgen radiation for its wider and deeper distribution. For these reasons, I have been trying to combine the use of high voltage roentgen rays with radium according to Keynes' method in the treatment of primary carcinoma of the breast. My impressions from this combination are favorable, but my experience is too limited and too recent to be considered in any detail.

During the twenty-six years covered by

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this study up to June, 1928, there have been, from time to time, great improvements made in the technique, such as the use of various filters (from leather to copper), varying methods of application (fractional, massive, saturation, general, local, tangential) and in the equipment (gas tubes, Coolidge tubes, coil, rectifying transformer, valve tube outfits, and low voltage to high voltage outfits). I should like to give due credit to the various authors who have contributed to this progress, as well as to those who have made similar statistical reviews but time will not permit. However, any statistics covering a period of twenty-six years must be only an average of the results obtained under these varying conditions. We are convinced that our results have been gradually improving to date, as has been shown by our previous papers on this subject. I believe that by combining the principles of the Keynes technique in the use of radium, our results in the treatment of primary carcinoma of the breast, especially, should improve.

In the great majority of instances, as the following statistics will show, it is almost entirely the inoperable cases that are referred for primary or preoperative treatment, and chiefly the more advanced cases (instead of all) that are referred for postoperative irradiation. The recurrent and metastatic cases make up the greater group, and such cases are not even included in the usual surgical statistics. Therefore, a direct comparison of the results from radiation treatment cannot be made with those in surgical statistics in which practically all are primary cases.

The great variation in the extent of the disease, either primary or recurrent, together with the variability in the degree of malignancy and the degree of sensitivity to irradiation, makes classifications extremely difficult. We have, therefore, made use of numerous tables to determine the value under these variable circumstances. It is well known that in all surgical clinics many cases are not treated at all because they are beyond any surgical relief, and therefore are not included in surgical statistics, while practically all cases are treated by radiation, and therefore have been included in our statistics.

In most surgical statistics the cases are classified on the basis of operability. All surgeons, today, consider tumor tissue which is movable and confined to the breast as operable; most surgeons consider cases in which the axilla has been invaded as operable, but practically none consider a case with supraclavicular involvement as operable.

The end-results of irradiation of cancer of the breast are affected not only by the extent of the disease, but by the type of the cancer, the rapidity of the growth, the age of the patient, the extent of the metastasis, the regions invaded, the general physical condition of the patient, the duration of the symptoms before primary treatments or before operation, the duration of the recurrence and metastases before irradiation has been begun, and also by the time interval between operation and the postoperative irradiation.

We have therefore taken these factors into account, so far as is practical in making up these statistics. We have previously made statistical reviews of our breast cases in 1925, 1928, 1929, 1930, and now bring this review up to June, 1931 (cases treated previous to June, 1928).

In our previous reviews, as well as in this one, we counted as dead all patients who could not be traced. Since the 1925 report, and in each subsequent report, we have been able to trace some of the missing cases. This has made an improvement in some of our percentage values. When cases could not be traced, we counted them as living only to the date of our last record.

Portmann[1] has tried to determine the average natural duration of cancer of the breast by a review of other compilations reported in literature as follows:

[1] Portmann, U. V. Surgery and the x-ray in the treatment of carcinoma of the breast. *Radiology*, 1928, *10*, 377–382.

Lazarus-Barlow and Leeming	36 months
Paget	48 months
de Kop	29 months
Sprengel	27 months
Sibley, Baker, Giss, Williams	34 months
Lee	40 months
Rodman	30 months
Haggard and Douglass	26 months
Average	34 months

The average duration of our cases was 16.2 months before operation or radiation treatment and the average after operation plus irradiation in the 263 cases (postoperative group) was 68.8 months—total 85 months.

He has also listed the results obtained by 32 surgeons as compiled from the literature which showed a survival in the *operable cases* at the end of *three years*, of 38.6 per cent and at the end of *five years*, 28.8 per cent. He also found from the few available reports that the average incidence of *recurrences* during the *first year following surgical operation alone is 25 per cent.* In a series of 111 cases studied in the Cleveland Clinic since 1924, he found following surgery alone, 24 per cent of recurrences within the first year, while when operation was combined with irradiation only 18 per cent of recurrences occurred during the first year.

The analysis of my 1,022 cases is indicated by the following tables which will be supplemented by a few brief comments.

Comments: Tumor, *pain* or *injury* in 92 per cent of the cases first attracted the patient's attention to the disease in the breast. Any of these three conditions should lead to an expert examination within sixteen days instead of an average of sixteen months. When patients and the first physician consulted once grasp the importance of acting promptly, the mortality from cancer of the breast will be greatly reduced.

Table I

SEX, SOCIAL STATUS AND LOCATION

	Number	Per cent		Number	Per cent
Males	13	1.2	Married	782	76
Females	1,009	98.8	Single	240	24
Total	1,022	100.0		1,022	100

Right breast involved in 478 cases, or 47 per cent.
Left breast involved in 491 cases, or 48 per cent.
Both breasts involved in 53 cases, or 5 per cent.

Table II

CONDITIONS WHICH FIRST ATTRACTED ATTENTION TO THE TUMOR

Tumor	56 per cent of cases	92 per cent
Pain	20 per cent of cases	
Injury	16 per cent of cases	

The remaining 8 per cent gave as the first complaint the following symptoms:

Stinging sensations	Tender axilla—neck
Eczema of nipple	Dimpled skin
Bleeding nipple	Sinus in breast
Discharge from nipple	Pigmented mole
Ulceration of nipple	Pain right under abdomen
Soreness in nipple	Rheumatism in back, etc.
Retraction of nipple	Swollen arm
Increase in size of breast	Cough
Lump in axilla	Dyspnea
Lump in neck	Cachexia
Abscessed breast	Anemia

TABLE III

TIME INTERVENING BETWEEN THE FIRST SYMPTOM AND ACTIVE TREATMENT BY EITHER OPERATION OR IRRADIATION (Average 16.2 months)

Time	Cases
1 month	110
2 months	98
3 months	46
4 months	60
5 months	70
6 months	69
7 months	42
8 months	24
9 months	11
10 months	23
11 months	23
1 year	123
2 years	115
3 years	108
4 years	23
5 years	22
6 years	13
7 years	7
8 years	11
9 years	4
10 years and over	3
Total	1,005 cases
No record on this point	17 cases
	1,022 cases

TABLE IV

AGE INCIDENCE

Years	No. of Cases
16	1
18	1
20 to 30	24
30 to 40	128
40 to 45	165
45 to 50	199
50 to 55	166
55 to 60	106
60 to 65	110
65 to 70	55
70 to 75	39
75 to 80	20
80 to 85	8
Total	1,022 cases

64.3 per cent of all cases were between the ages of thirty and fifty-five.

2.5 per cent were under thirty years of age.

Comments: The early recurrences recognized within a few weeks can only occur when there has been an incomplete removal of the local or palpable disease—the so-called "palliative operation". The congestion following the traumatism of the operation by increasing the blood supply to the cancer cells hastens their growth and on this account the local cancer tissue or neighboring metastasis may become prominent before the wound is healed.

The latest local recurrence occurred after eighteen years. This was in a very old woman. The most striking fact is that 64 per cent of the recurrences develop within the first year, and 42 per cent recur within the first six months.

TABLE V

AVERAGE TIME DURATION FROM OPERATION TO RECURRENCE

(Average 19.7 months)

276 Cases, or 64 per cent, had Developed the Recurrence Within the First Year

Recurrence within	Cases
1 week	4
2 weeks	10
3 weeks	8
4 weeks	35
5 weeks	3
6 weeks	5
7 weeks	1
8 weeks	23
3 months	21
4 months	29
5 months	16
6 months	28
7 months	14
8 months	11
9 months	11
10 months	10
11 months	2
1 year	45
1½ years	34
2 years	40
3 years	22
4 years	21
5 years	10
6 years	7
7 years	6
8 years	6
9 years	2
10 years	3
11 years	1
12 years	1
13 years	1
15 years	2
18 years	1
Total	433 Cases

In the report made by Buchholz, it was found that one-third (Portmann, 24 per cent) of the cases having complete operation (but not followed by irradiation) developed recurrence within the first year. These facts should be sufficient to indicate the desirability of instituting postoperative irradiation within the shortest time possible, which is usually within two weeks after operation. The average time at which our cases have reached us after operation has been four weeks. This high percentage of early recurrences should also give encouragement to those patients who have passed the first six months or a year.

TABLE VI

RECURRENT CASES—TIME INTERVAL BETWEEN THE FIRST SIGN OF RECURRENCE AND THE BEGINNING OF RADIATION TREATMENT

(Average 6.8 months)

Time	Cases
2 weeks	10
3 weeks	12
4 weeks	59
5 weeks	4
6 weeks	11
7 weeks	3
8 weeks	65
3 months	50
4 months	19
5 months	25
6 months	36
7 months	11
8 months	9
9 months	9
10 months	3
11 months	2
1 year	70
1½ years	12
2 years	11
3 years	4
4 years	4
5 years	4
Total	433 Cases

Comments: Surely sufficient work has been done to indicate that irradiation is the best treatment for recurrences and therefore a delay of an average of 6.8 months can only mean insufficient "follow-up" after operation, fear of the truth on the part of the patient or a hopeless attitude on the part of the surgeon. The delay in irradiating recurrent cancer should be reduced from an average of 6.8 months to that many days.

TABLE VII

AVERAGE TIME INTERVENING BETWEEN OPERATION AND IRRADIATION IN RECURRENT GROUP

(Average 22.7 months)

Treatment Started	No. of Cases
3 weeks	4
4 weeks	7
5 weeks	1
6 weeks	6
7 weeks	6
8 weeks	26
3 months	24
4 months	21
5 months	23
6 months	21
7 months	11
8 months	19
9 months	8
10 months	12
11 months	7
12 months	41
1½ years	50
2 years	43
3 years	30
4 years	21
5 years	19
6 years	8
7 years	8
8 years	6
9 years	2
10 years	3
11 years	1
12 years	1
13 years	1
15 years	2
18 years	1
Total	433 Cases

Comment: We believe that many or most of these recurrences could be prevented by prompt postoperative irradiation instead of giving the treatment after the recurrence and on an average of 22.7 months after the operation.

TABLE VIII

SHOWING OPERATIONS FOR RECURRENCES BEFORE BEING TREATED BY IRRADIATION

40 cases, 1 operation before second recurrence.
25 cases, 2 operations before third recurrence.
8 cases, 3 operations before fourth recurrence.
5 cases, 4 operations before fifth recurrence.
4 cases, 5 operations before sixth recurrence.

Total 82 cases = approximately 19 per cent of the 433 recurrent and metastatic cases after operation.

Comments: Operations for recurrences are sometimes advisable because of the doubt as to recurrence, which then permits a microscopical examination and then vigorous irradiation. We believe that before operating for such recurrences it is desirable to give preoperative irradiation to devitalize the cancer cells. In such instances the operation can follow promptly after the irradiation.

TABLE IX

HISTOLOGICAL CLASSIFICATION

	Cases
None obtained (including primary operable—only 13 cases were clinically doubtful)	124
None made (inoperable primary and recurrent)	147
"Carcinoma"	240
"Malignant"	129
"Fibroadenoma" (these cases were sent to us because of later recurrence and metastasis)	18
Colloid carcinoma	2
Paget's disease	8
Adenocarcinoma	83
Medullary carcinoma	15
Scirrhous carcinoma	172
Carcinoma simplex	42
"Benign tumor" (sent to us later because of recurrence and metastasis	11
Carcinoma en cuirasse*	30
Papilliferous cyst carcinoma	1
Total	1,022

* The diagnosis submitted by the surgeon or pathologist.

Comment: In this entire group of 1,022 cases, there were 271 cases in which there were no histological examinations, but in both the inoperable primary cases and the recurrent cases (147) there was no doubt in the mind of the referring surgeon nor in our minds as to the diagnosis of carcinoma. In the remaining 124 cases which were technically operable, but in which there was some contraindication to operation or in which operation was refused, the diagnoses had been made by competent surgeons as well as by ourselves and of these, only 13 were doubtful. The "fibroadenoma" cases (18) had been operated upon and the histological examination showed "fibroadenoma," but they developed recurrent carcinoma and were referred to us for treatment of the recurrences. It is remarkable therefore that the number of doubtful or erroneous histological diagnoses (18) should be even greater than the 13 doubtful clinical diagnoses.

Comments: Only 9 per cent of the 1,022 cases received both preoperative and postoperative irradiation. These cases were mostly far advanced, in which the inoperable cases were made operable. Only 25 per cent of the 1,022 cases were referred for prophylactic irradiation after operation. We are convinced that all cases should be given prophylactic irradiation after operation. Table x shows especially that 43 per cent of the 1,022 cases were referred for irradiation because of recurrences or metastases. We are convinced that many of these recurrences, and some of the metastases, could have been prevented by thorough prophylactic irradiation. The next striking feature is that only 6 per cent of all cases were treated primarily by irradiation *while in an operable stage*, and most of these were physically unfit or refused operation. We try to get the advice and cooperation of a competent surgeon in every primary case treated by irradiation.

Comments: The values in the different groups of carcinoma of the breast as shown in Table xi can be appreciated only if one considers the extent and character of the disease in the separate classes in each group. For example, the 50 per cent of recoveries in the group receiving both preoperative and postoperative irradiation is less than the 55 per cent of recoveries in the group that received only "postoperative" irradiation. This is clearly due to the fact that a more advanced type of disease was present in the former group. Many of these were changed from "inoperable" to "operable" cases. We are thoroughly convinced of the value of preoperative irradiation.

In the "postoperative" group, there were 55 per cent of five-year recoveries but if one eliminates the 49 cases in which the disease was confined to the breast, there remain 191 cases which have been under observation five years or more and of these

TABLE X

CLASSIFICATION OF TYPES AND EXTENT OF INVOLVEMENT IN 1,022 PRIVATE PATIENTS WITH CANCER OF THE BREAST

The groups under each subdivision are classified after the fashion of the generally accepted surgical tables:

Group I.....Early operable—no glands involved
Group II.....Late operable with glands involved
Group III.....Local recurrence—operable
Group IV.....Local recurrence, inoperable, primary and secondary

	Group	Before Operation	After Operation	No. of Cases	Per Cent
		a. Cases receiving both preoperative and postoperative irradiation			
A	I	No glands	No glands	20	21
B	II	Glands	No glands	37	39
C	IV	No glands	Glands (not removable)	19	20
D	IV	Glands	Glands (not removable)	19	20
			Total	95	9*
		b. Cases receiving postoperative irradiation			
E	I	No glands at operation, and no glands when irradiation was begun		60	23
F	II	Glands at operation, but no glands when irradiation was begun		100	38
G	IV	Glands at operation, and glands when irradiation was begun		76	29
H	IV	No glands at operation, glands when irradiation was begun		27	10
			Total	263	25*
		c. Cases of recurrences and metastases treated by irradiation			
I	III	Local recurrence		62	15
J	IV	Local recurrence in glands, axilla and supraclavicular region		69	16
K	IV	Local recurrence metastasis, mediastinum—lungs		31	7
L	IV	Local recurrence in axilla and supraclavicular and mediastinal regions		220	50
M	IV	Local lesion and metastasis to spine and other bones		19	4
N	IV	Metastasis, mediastinum, lungs and bones		32	8
			Total	433	43*
		d. Primary inoperable cases treated by irradiation			
O	IV	Fixed to skin or glands with axillary supraclavicular and mediastinal distribution		117	66
P	IV	Fixed to skin or glands with axillary, supraclavicular involvement plus bone metastasis		33	19
Q	IV	Made operable without chest metastasis		20	10
R	IV	Made operable with chest (palliative operation)		5	3
S	IV	Removed by electrocoagulation		3	2
			Total	178	17*
		e. Primary operable cases treated by irradiation			
V	I	Primary operable, unquestionably malignant (refused or physically not fit)		40	76
T	I	Primary operable, questionably malignant, (3 Per cent of all cases)		13	24
			Total	53	6*

* Percentage of 1,022 cases.

TABLE XI

STATISTICAL STUDY OF RADIATION THERAPY IN CARCINOMA OF THE BREAST (1,022 CASES). DURATION OF LIFE AFTER THE BEGINNING OF TREATMENT—1902 TO JUNE 1, 1928, WITH VARYING TECHNIQUE

Other Details and Abbreviated Words are Shown in Table X

	Group		Total	Well over 3 yr.	Well over 5 yr.	Well over 10 yr. (Cases before June 1921)	Well over 15 yr. (Cases before June 1916)
		a. Cases receiving both preoperative and postoperative irradiation (92 cases)					
A	I	Op. no invol. of gl.	20	13 of 20 65%	10 of 17 58%	5 of 11 45%	3 of 8 37%
B	II	Op. with invol. of gl.	37	23 of 37 62%	*19 of 33* 57%	5 of 22 22%	0 of 4 0%
C	IV	No gl. at op.-gl. after op.	19	10 of 19 52%	7 of 17 41%	1 of 10 1%	1 of 4 25%
D	IV	Gl. at op. and gl. after op.	19	13 of 19 68%	3 of 11 27%	0 of 3 0%	0 of 2 0%
		Total and Average	95	59 of 95 62%	*39 of 78 50%	11 of 46 23%	4 of 18 22%
		b. Cases receiving postoperative irradiation (263 cases)					
E	I	No gl. op.—no gl. when irrad.	60	58 of 60 96%	43 of 49 87%	20 of 29 69%	9 of 14 64%
F	II	Gl. op.—no gl. when irrad.	100	64 of 100 64%	*57 of 98* 58%	26 of 81 32%	7 of 36 19%
G	IV	Gl. op.—gl. when irrad.	76	31 of 76 40%	24 of 70 34%	9 of 59 15%	4 of 36 11%
H	IV	No gl. op. —gl. when irrad.	27	15 of 27 55%	8 of 23 34%	3 of 11 27%	1 of 5 20%
		Total and Average	263	168 of 263 63%	*132 of 240 55%	58 of 180 32%	21 of 91 23%
		c. Recurrent cases treated by irradiation (433 cases)					
I	III	Local recurrence	62	35 of 62 56%	29 of 62 46%	15 of 48 31%	10 of 38 26%
J	IV	Rec. gl. ax. and s.cl.	69	28 of 69 40%	14 of 65 21%	8 of 52 15%	3 of 34 8%
K	IV	Rec. met. med. and lungs	31	7 of 31 22%	4 of 30 13%	2 of 16 12%	0 of 3 0%
L	IV	Rec. ax. and s.c. and med.	220	83 of 220 37%	29 of 210 13%	8 of 183 4%	5 of 82 6%
M	IV	Loc. les., met. spine and bones	19	7 of 19 36%	4 of 14 28%	1 of 6 16%	0 of 4 0%
N	IV	Met. med.—lungs and bones	32	4 of 32 12%	1 of 27 3%	0 of 12 0%	0 of 3 0%
		Total and Average	433	164 of 433 37%	* 81 of 408 17%	34 of 317 10%	18 of 164 10%
		d. Primary inoperable cases treated by irradiation (178 cases)					
O	IV	Fix. sk. or gl. and ax. s.cl. and med.	117	41 of 117 35%	27 of 108 25%	16 of 80 20%	6 of 37 16%
P	IV	Fix. sk. or gl. and ax. s.cl. and b. met.	33	13 of 33 39%	7 of 23 30%	2 of 12 16%	0 of 17 0%
Q	IV	Made op. without chest met.	20	17 of 20 85%	11 of 19 57%	4 of 12 33%	1 of 7 14%
R	IV	Made op. with chest (pall op)	5	2 of 5 40%	2 of 5 40%	2 of 4 50%	0 of 3 0%
S	IV	Remov. by electrocoagulation	3	2 of 3 66%	1 of 3 33%	0 of 2 0%	0 of 0 0%
		Total and Average	178	75 of 178 42%	*48 of 158 30%	24 of 110 21%	7 of 64 10%
		e. Primary operable cases treated by irradiation (53 cases)					
V	I	Prim. op. unques. malig. (refused or phys. not fit)	40	36 of 40 90%	30 of 37 81%	19 of 21 90%	11 of 18 61%
T	I	Prim. op. quest. malig. (1% of all cases)	13	11 of 13 84%	10 of 13 76%	8 of 11 72%	4 of 6 66%
		Total and Average	53	47 of 53 88%	*41 of 50 82%	27 of 32 84%	15 of 24 62%
		Grand Total and Average	1,022	513 of 1,022 50%	341 of 934 36%	154 of 685 22%	65 of 361 18%

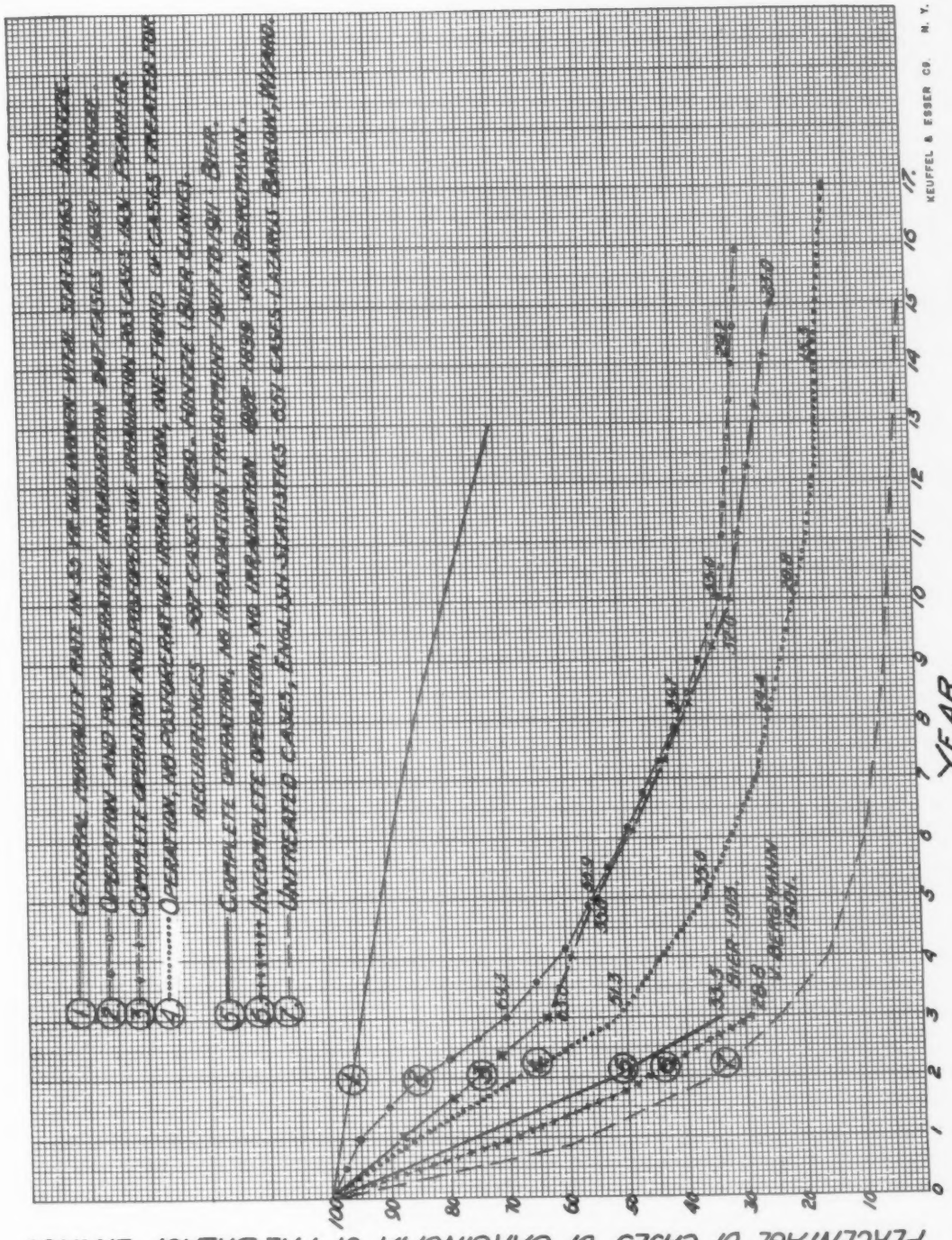

CHART 1. Value of irradiation in carcinoma of the breast.

Grand Total and Average..... 1,022 513 of 1,022 50% 341 of 934 36% 154 of 685 22% 65 of 361 18%

there were 46.6 per cent of five-year recoveries in advanced carcinoma, which is more than twice the average recoveries from surgery alone, when there are palpable lymph nodes.

It is worthy of observation that in the group of "inoperable primary cases," there were 30 per cent alive at the end of five years or more. Many of these cases had at the end of treatment contracted scars, fibrous masses, and other evidence of possible disease which does not enable one to refer to them as cures, for when such cases are operated upon or autopsies are performed and microscopical examinations are made, one often finds nests of cancer cells imbedded in fibrous tissue. Still it is a considerable salvage from an otherwise hopeless group, by giving them a considerable prolongation of life with reasonable comfort.

In the "primary operable group" in which the diagnosis was not doubtful there were only 37 cases, but of this group, 81 per cent were symptom-free at the end of five years. This is encouraging and perhaps when we have mastered the technique of combining the use of interstitial irradiation from highly filtered radium, it may be advisable to undertake treatment in more primary cases.

The most striking showing on the value of irradiation is the recovery of 36 per cent of the 934 cases that have passed the five-year period. This represents the absolute recovery value of the average of all cases of carcinoma of the breast.

Comments: Table XII which is a summary of other detailed analyses shows a very definite improvement in results in all groups as a result of improvements in apparatus and technique. This improvement is dated from 1922 when the use of high voltage roentgen rays was begun and when the "saturation" technique became a routine. There has been, however, a progressive evolution in technique and detailed management during the past twenty-nine years. The average of five-year recoveries, *of all cases*, since 1922 is 40 per cent as compared with 33 per cent previously. This is not due merely to improved equipment, nor to any special standard technique but also to greater attention to all details, such as accurate measurement of dosage, conservation of normal tissue, wider distribution of the prophylactic irradiation, etc. *We have no standard technique for all cases and until we can make cancer develop and distribute itself in some standard manner no standard technique can be developed. Every case must be treated according to the individual indications.*

TABLE XII

COMPARATIVE RESULTS BEFORE 1922 (LOW VOLTAGE) AND AFTER 1922 (HIGH VOLTAGE AND "SATURATION" TECHNIQUE)

	1902 to 1922 Low Voltage—Variable Technique		1922 to 1928 High Voltage and "Saturation"	
	3 years per cent	5 years per cent	3 years per cent	5 years per cent
Preoperative and postoperative—all classes	55	47	69	55
Postoperative and with no ax. glands	96	84	96	94
Postoperative with ax. glands	63	55	70	73
Postoperative—all classes	59	49	80	77
Recurrence and metastatic—all classes	39	19	34	24
Primary inoperable—all classes	42	30	42	30
Primary operable—clinically positive	87	87	93	69
Average results in all cases treated	48	33	56	40

TABLE XIII

RESULTS OF OPERATION IN CARCINOMA OF THE BREAST WITHOUT IRRADIATION AND WITH IRRADIATION

Author	Without Involvement of Glands				With Involvement of Glands			
	Operation without Irradiation		Operation with Irradiation		Operation without Irradiation		Operation with Irradiation	
	3 years	5 years	3 years	5 years	3 years	5 years	3 years	5 years
Greenough: *South. M. J.*, 1925, *18*, 187	47%	—	—	—	19%	—	—	—
Bloodgood: *Radiology*, 1924, *2*, 162	—	70%	—	—	—	20%	—	—
Lee: *Am. J. Roentgenol.*, 1924, *12*, 535	—	—	—	—	—	15%	—	—
Schmitz: *Am. J. Roentgenol.*, 1924, *12*, 531	—	—	—	64%	—	—	—	42%
Wintz: *Brit. J. Radiol.*, 1926, *31*, 150	Including all operable		cases	77%	—	—	—	—
Schreiner: *Cancer*, J. B. Lippincott, 1931	—	—	—	63%	—	—	—	23%
Perthes: *Zentralbl. f. Chir.*, 1924, *51*, 264	—	—	—	—	35.4%	25%	28.5%	—
Anschütz and Hellmann: *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, *35*, 94	100%	100%	100%	100%	41.4%	31%	59%	42%
Harrington: *J. Am. M. Assn.*, 1929, *92*, 208	79%	70.5%	80%	66.2%	37.8%	22.8%	41.3%	22.3%
Hehmann: *Zentralbl. f. Chir.*, 1924, *51*, 262	—	—	—	—	17.9%	—	41.7%	—
Hoffman: *Beitr. z. klin. Chir.*, *121*, Heft 2.	—	—	—	—	29.3%	—	40.0%	—
Hintze: *Klin. Wchnschr.*, 1929, *8*, 644	—	—	Including all operable cases		53.3%	35.3%	69.8%	45%
Buchholz: *Strahlentherapie*, 1928, *29*, 698	—	—	Including all operable cases		24.0%	22.3%	54.0%	45.2%
Westermark: *Acta radiol.*, 1930, *11*, 1–32	—	—	—	60%	—	—	—	29.5%
Pfahler: Review to June, 1931	—	—	96%	87%	—	—	54.1%	46.6%
Average percentage from various authors	75%	80%	92%	74%	32%	24.5%	50%	37%

The best results will be obtained by the radiologist who has the most knowledge about cancer; the most knowledge about the principles of radiation therapy; the keenest clinical judgment, and the greatest ability and patience in their application to the individual case. The instruments used in radiation therapy are of no more use in themselves than surgical instruments are of use without the skill and clinical judgment of the surgeon. Details of technique have been discussed in previous papers and are omitted here for the sake of brevity.

In this collection of 1,022 cases of carcinoma of the breast, there were 127 cases in which radium was combined with the roentgen therapy. The radium was used for intensive local effect either by interstitial implantation or by local surface application. In my private clinic I have only 1,250 milligrams of radium and therefore it has not seemed either practical or economical to use radium at a distance for wide distribution of effects. It does not appeal to me theoretically for one cannot direct the radium irradiation so well to the likely areas of lymphatic distribution, nor can one use the radium for tangential irradiation as has been so well recommended by Holfelder for roentgen irradiation. A detailed analysis of the cases in which radium was also used shows no higher percentage of recoveries than in those in which the roentgen rays alone were used. In other words, the radium was used for some special indications in the individual case. In none of these cases reported have we used the Keynes technique. That work is more recent.

Comments: It will be observed from Table XIII that there is considerable variation in the percentage of recoveries according to different authors when surgery alone is used, and there is also considerable variation in the percentage of recoveries when surgery is combined with irradiation. These differences may be due in part to difference in technique, but it is likely that the difference is due chiefly to the type of case that comes under treatment, and the differences in classification. The general averages, however, give a fair idea of the relative value of surgery alone, or surgery combined with irradiation. It will be seen that in the group of cases in which the disease consists of a movable tumor confined to the breast about 75 per cent show five-year recoveries. It may also be observed that in this group, surgery alone accomplishes about as much as when irradiation is added. Since the great majority of cancers of the breast have passed this stage when they first come under active treatment, our chief interest must be centered in those in which the disease is no longer localized. In those cases which have passed the first stage, it will be seen that an average of 24.5 per cent are well at the end of five years from surgery alone and *an average of 37 per cent are well at the end of five years when irradiation is combined with operation, or a gain of 51 per cent. Our own results show 46.6 per cent well at the end of five years or a gain of 90 per cent, as compared with the average of surgery alone.*

Comments: Chart I shows very graphically that at the end of 3 years, of those cases of cancer of the breast receiving no treatment, 24 per cent will be alive; if incompletely operated upon, approximately 29 per cent will be alive; if a complete operation is done and no irradiation, about 51 per cent will be alive; and if a complete operation is done and skillful irradiation added, approximately 66 per cent will be alive. I think if these facts are placed before a patient, the patient will request an operation, with the addition of irradiation.

At the end of five years with no treatment, 12 per cent will be alive; with surgery alone, 35 per cent; and with surgery combined with irradiation, 55 per cent will be alive. It seems, therefore, that it has been sufficiently demonstrated that even with our present imperfect knowledge and imperfect technique, irradiation is proved to be of definite value in the treatment of cancer of the breast and that when the irradiation is given skillfully and thoroughly, the patient's chances are nearly doubled as compared with surgery alone.*

* For discussion see page 556.

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THE OCCURRENCE OF ROENTGEN PLEUROPNEUMONITIS IN TREATMENT OF BREAST CANCER*

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THE term roentgen pleuropneumonitis is intended to cover any and all undesirable radiation effects in the chest wall, pleura, and lungs, and this term is used interchangeably with pleuropulmonitis and pulmonary fibrosis.

At this time, most of the centers of population are supplied with a sufficient number of surgeons, and some of these encounter no difficulty in considering the occasional case of roentgen pleuropneumonitis as a contraindication for any radiation treatment and therefore as a direct indication for immediate operative procedure.

At the Steiner Cancer Clinic, except in very occasional cases, it has been our practice to give preoperative as well as postoperative irradiation, this policy being based upon the well-established fact of definite improvement observed in many far-advanced inoperable cases, without untoward effects in any type of case.

Roentgen pleuropneumonitis was first described by Groover, Christie and Merritt[1] in 1921, since which time many references to the condition have appeared in the literature. Following the development of the German technique a few years ago, stressing increased voltage, heavy filters, and greater skin target distances, it was thought that much damage to the deep structures might easily occur.

Clinically this condition is characterized by an annoying, harsh, unproductive cough with varying degrees of dyspnea, especially noticeable upon exertion. The general condition of the patient is very much better than the appearance of chest films would indicate or justify. In the case reported here the patient was not aware of the existence of three fractured ribs.

Roentgenologically the appearances are precisely what would be expected in the early stages of so-called massive collapse of the lung, if this collapse should occur slowly, requiring five or six days to reach its maximum of involvement. The diaphragm on the affected side is elevated and fixed. The mediastinum and contents are displaced toward the involved side and there is a diffuse cloudiness of the entire lung field. After a considerable period of time, variously estimated as from three to six or eight weeks, the haziness clears up, and films then show a varying degree of fibrosis, which with the fixation of the diaphragm and displacement of the mediastinal shadows toward the affected side, remain as permanent after-effects of the condition. These gross anatomical changes are due to retractive stress which may manifest sufficient force to cause fracture of the ribs.

Intrathoracic malignancy, either primary or secondary, is easily differentiated from pleuropneumonitis in that no manifestation of malignancy in the thorax ever causes fixation of the diaphragm and displacement of mediastinal shadows toward the affected side. In early stages, infiltration of the lung advances much more rapidly in pleuropneumonitis than in any form of malignant growth. The general clinical condition of the patient is incompatible with malignancy of the same degree of involvement.

Roentgen pleuropneumonitis has seldom been observed except in cases where repeated irradiation of the chest wall has occurred. Evans and Leucutia, in 1925, estimated the dosage necessary to damage intrathoracic tissue as follows: A dose of from

[1] Groover, T. A., Christie, A. C., and Merritt, E. A. Intrathoracic changes following roentgen treatment of breast carcinoma. Am. J. Roentgenol. & Rad. Therapy, 1923, *10*, 471–476.

* Read in the Symposium on Carcinoma of the Breast at the Sixteenth Annual Meeting, American Radium Society, Philadelphia, Pa., June 8–9, 1931.

40 to 100 per cent skin unit dose repeated three or four times at intervals of from two to six months or a single dose of more than 140 per cent; and they stated further that if a dose of from 100 to 140 per cent S.U.D. is repeated before the infiltration due to the first treatment has had time to clear up, entire loss of lung function may follow.

Many of the cases reported have followed treatment with long wave length or suberficial therapy methods. My impression is that the size of the port of entry has a very important bearing upon the production of pleuropneumonitis.

At the Steiner Cancer Clinic practically all deep therapy patients are treated at 200 kv., 50 cm. skin target distance, with 0.5 mm. copper and 1 mm. aluminum filters, over a 10 by 10 cm. field, for such time as is necessary to produce on the skin of the treated area a slight reddening in a few days, followed by tanning and in some cases by slight branny desquamation. This we consider an erythema dose. During the years 1925 to 1930, 670 patients received 4,170 treatments on the thorax, and many of these patients have had repeated cycles of treatment at intervals of from two to three months. Careful observation has failed to show the development of a single case of clinical pleuropneumonitis. Microscopic examinations of autopsy material for the study of fibrotic changes in lung tissue following repeated irradiation have been made by Dr. E. L. Bishop, pathologist at the Steiner Clinic, who sums up his findings as follows:

Fig. 1.

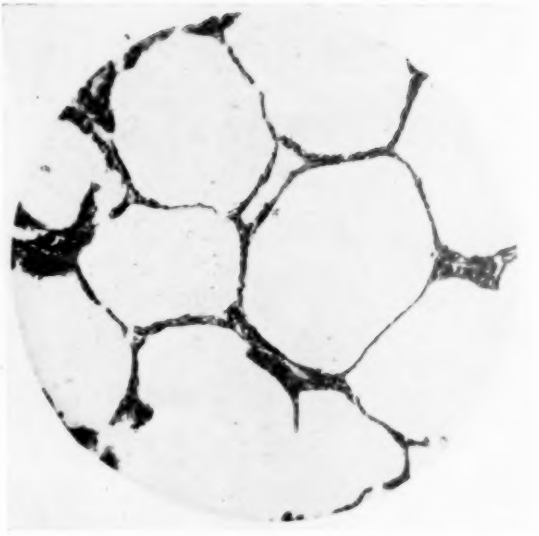

Fig. 2.

"In several cases of mammary cancer which have come to autopsy, an effort has been made to determine what effect, if any, the external radiation of the tumor area, before and after operation, had upon the lungs. Many of these cases have shown massive metastases, which for the time being precluded their being used in this study; others had received deep therapy for shorter periods of time, so that pulmonary changes were indefinite, slight or absent. However, two cases recently examined, both of which had received irradiation over a comparatively long period, are compared here for examples of some of the changes in the lungs which have been encountered in such cases.

"Path. No. 4731, Mrs. C., received deep therapy over the right side of the chest, following radical breast removal. At autopsy, although there was no recurrence in the operative scar, or chest wall, the right lung immediately beneath the breast area was adherent to the chest wall over an area 7 cm. in diameter. The lung tissue was of bluish-gray color, moderately firm, with some edema and very little air. No other adhesions were found in either lung and no metastatic nodules were seen or felt in either lung or pleura. There was

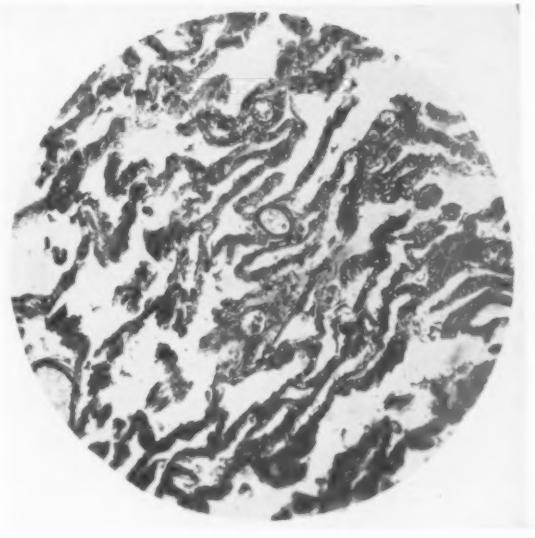

Fig. 3.

a beginning pneumonia of the *left* lower lobe. Microscopically there was a distinct atelectasis in the adherent portion of the right lung, with the alveoli almost completely compressed, and definite swelling and thickening of the alveolar walls (Fig. 1). Massive connective tissue production was not seen and no change in the small bronchi was noted. One small area, less than a low power field in diameter, containing neoplastic cells, was found within this portion of the lung, more probably a metastasis than direct extension of the tumor, for it could not be traced to the chest wall.

"The opposite lung, which had received no irradiation, showed none of the changes above described (Fig. 2). The alveoli are large and the walls fine, in fact some of the spaces were almost emphysematous in size.

"Another case, Path. No. 4763, Mrs. O., is somewhat more difficult to analyze, on account of an acute suppurative process in the right side of the chest. In this case, both sides of the chest received heavy irradiation, the left more than the right. The right lung and pleural cavity was the seat of a large abscess with very little lung remaining, a part of the upper lobe, which was very boggy and edematous. The left lung filled the chest cavity and there were a few fine adhesions, widely scattered. Gross metastases were limited to the lower lobe. Very little fluid was present. In the microscopic sections, both lungs showed a structure similar to that described in the irradiated lung of the previous case, i.e., compressed alveoli and thickening of the alveolar walls, with swelling or desquamation of the alveolar epithelium (Fig. 3). While microscopic metastases were found in both lungs, the partial or complete atelectatic areas were often without evidence of neoplastic involvement.

"It is at least interesting to note the histological changes which were found in the irradiated lungs in contrast to the practically normal lung structure in the unirradiated areas. Whether these changes are constant or not can be determined only by study over a long period of time, for no conclusions can be drawn from the cases examined so far, most of which received much less treatment than the two described above."

The history of the case which I wish to report is as follows:

Mrs. C. K., aged forty-eight, was referred to the Steiner Cancer Clinic on August 27, 1921, by her surgeon for radium treatment of a recurrent nodule on the right chest wall.

Her family and past history were considered irrelevant. Present illness was first noted as a small lump in the right breast four years previously, and six months after the tumor was discovered, a radical mastectomy was done. About three years after the removal of the right breast, there was discovered in the left breast a mass which caused retraction of the nipple and fixation of the skin overlying the mass. The left

Fig. 4.

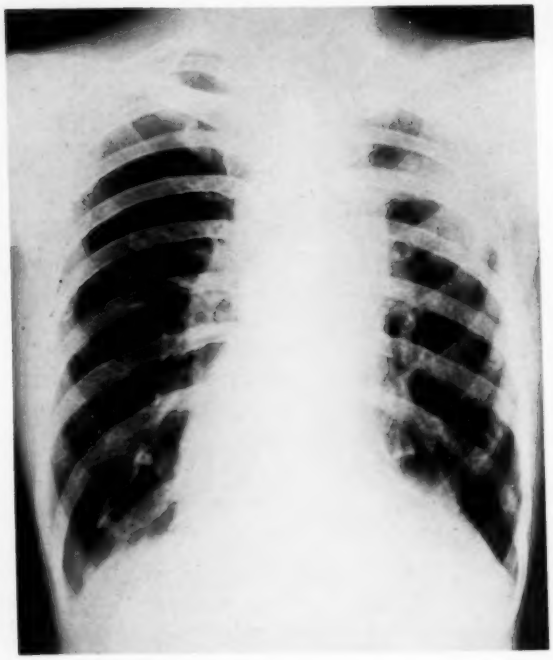

Fig. 5.

Fig. 6.

breast was removed in November, 1926. Preoperative superficial irradiation was given over the left breast, and this treatment was repeated twice after the operation. Sometime in the early part of 1927, the patient had two cycles of treatment over the entire right chest wall. In April, 1927, the patient had what she described as a severe attack of influenza. Careful questioning of both the patient and her husband failed to elicit any history of even slight trauma to the chest wall for the past fifteen years. The patient complained of slight dyspnea and troublesome cough, but did not attach any great importance to these symptoms. Photograph of the chest wall made August 22, 1927 (Fig. 4) shows an ulcerated lesion just outside the scar, and a photograph made June 22, 1928, showed some increase in the size of the lesion, with extension of the induration.

The roentgenogram taken August 27, 1927 (Fig. 5) shows some displacement of heart shadow and mediastinum toward the right side with elevation and irregularity of the right diaphragm, a probable compensatory emphysema of the left lung and unmistakable fractures of the fifth, sixth and seventh ribs on the right. The roentgenogram taken ten months later, in June, 1928 (Fig. 6) shows remarkably little change in the appearance of the chest.*

* For discussion see page 556.

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POSTOPERATIVE ROENTGEN THERAPY FOR CANCER OF THE BREAST*

A REPORT OF 103 CONSECUTIVE CASES

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CARCINOMA of the breast has always been looked upon as primarily a surgical problem. Within recent years the analysis of the results which are obtained by surgical procedures, together with our thorough understanding of the clinical course of the disease, would seem to give rise to the question as to whether or not operation alone is the final and satisfactory treatment of this disease.

Surgical extirpation of any malignant process in any location, by any technique, will completely eradicate every neoplasm if it is so localized that it has not extended beyond the area which can be excised. Unfortunately, such a favorable condition is seldom encountered and it is very uncommon to discover a case of cancer of the breast in which foci have not developed throughout the gland and extended into neighboring tissues, or in which the cancer has not metastasized to the adjacent lymph nodes or more distant areas. This fact is well demonstrated by examination of massive cross sections, introduced by Cheatle, of the entire breast in which numerous nests of neoplastic cells are found scattered throughout and involving most of the structures in a majority of specimens. Also it is well known from the reports of competent pathologists that the axillary nodes are involved in 95 per cent of specimens which are examined. It is very questionable whether malignant disease can be completely eliminated when the axilla is involved, even by the most skillfully performed operation, and it is probable that neoplastic cells remain after operation in a majority of instances. The axillary lymphatics drain directly into the supraclavicular nodes which are seldom removed because of the lack of clinical evidence of involvement and the technical difficulties. However, these supraclavicular nodes must be involved more frequently than is realized. The parasternal lymph nodes, which are likewise inaccessible, are often diseased.

The above facts indicate that in the majority of cases, cancer of the breast is a much more extensive process than is usually appreciated and therefore the most radical operations by any technique can seldom eliminate all of the neoplastic cells which may be present beyond the comparatively limited fields which are accessible to the surgeon. It is equally certain that operation is of little value to the patient as far as cure is concerned when neoplastic cells remain. That it is usually difficult to remove all neoplastic cells is exemplified by the well-known fact that metastatic and local recurrences are more likely to develop in obese individuals following operation more rapidly than in the case of the less robust individual. There are some who think that this is due to some inherent lack of resistance in obese persons but it is much more likely that the surgeon does not extract sufficient pounds of flesh from a large enough area because of the subsequent difficulty in covering the widely denuded area, and therefore neoplastic cells remain in the fat interspaces and in the skin where they develop very quickly and without restraint.

In most of the statistical reports of the results of operations, it is assumed that if a patient who has been operated upon for cancer of the breast has survived for from three to five years without evidence of the

* Read in the Symposium on Carcinoma of the Breast at the Sixteenth Annual Meeting, American Radium Society, Philadelphia, Pa., June 8–9, 1931.

disease the operation has effected some degree of benefit. However, if we study the clinical course of this disease in a large group of cases, we will be impressed by the fact that some individuals harbor neoplastic cells or even well-developed malignant tissue for several years without detriment to their well-being, and also that with or without operation, neoplastic cells may remain dormant for a long time before manifesting activity.*

We must also remember that cancer of the breast, per se, does not destroy life, but becomes fatal only when it has destroyed the function of vital organs. The process is a comparatively localized one lasting for varying periods of time during which none of the affected structures are essential to life and may be more or less destroyed by cancer without affecting the health of the host. Therefore, we may not assume that the cancer which involves these structures will immediately cause the death of the patient, nor that we have materially benefited or cured her by removing some of them by operation.

A review of a multitude of reports of statistical studies of the results which are obtained by operation for cancer of the breast shows that an average of approximately 40 per cent of patients are free from manifestations of the disease for a period of three years, and about 30 per cent for five years. Also a number of reports show that the average natural duration of life of patients with cancer of the breast is approximately three years. If an average of only 40 per cent of cases that are operable survive for three years after operation, which is the natural duration of life, we may very well question just how much is usually accomplished by radical operation for cancer of the breast, and there must be some doubt that surgery alone is an entirely satisfactory solution of the problem of treatment.

* For example, I treated a woman for vertebral metastases of a few months' duration, which developed from a fairly small proved cancer of the breast which undoubtedly, at least from clinical evidences, began twenty-seven years previously. It is not unusual to observe locally recurrent cancer long after operation, the longest period in my experience being twenty-two years.

The question as to when a cancer of the breast is operable from the standpoint of curability is therefore pertinent. Since 1897, when the radical operation was first advocated by Halsted, about 10 per cent more patients survive for five years after operation than was formerly the case. However, with this radical operation the surgeon has reached the ultimate limit of the amount of tissue which he is justified in removing by any technique and beyond which cancer frequently exists. Therefore, it must be apparent that some means must be devised whereby we may replace this radical surgery by a more or equally effective method, or that some beneficial procedure must be instituted to carry on as an adjunct because of the known limitations of operation.

It is about thirty years since roentgen rays and radium were first employed as therapeutic agents. It was soon found that some degree of benefit was derived when they were applied in the treatment of neoplastic diseases, even with the comparatively inefficient and limited technique which was then employed. It is only during the past ten years that we have known enough about the biological and physical properties of these agents to take them out of empirical therapy and establish them upon a scientific basis. The radiation therapy of even fifteen years ago may be compared to that dark era in surgery of three thousand years before Christ when, as the papyrus of Ebers tells us, it was recognized that axillary involvement was associated with cancer of the breast, and attempts were made to treat the disease by cautery, a method not unlike some of those which are in vogue in this present age of scientific enlightenment.

It is interesting to note that there are some individuals who still deny the possibility that radiation therapy may be of value in the treatment of cancer of the breast but they will admit having observed benefit in some hopelessly advanced cases or after recurrences or metastases have developed. It would seem to be a logical de-

duction that if radiation is of benefit in some of these types of cases which are hopeless from a surgical standpoint, others with earlier or less extensive involvement might also be benefited by radiation. Usually this skepticism is due to ignorance of the clinical course of the disease, badly correlated statistical studies, lack of understanding of the methods of applying radiation and of its effects, or to the observation of only inefficiently applied treatment, and not infrequently to the fact that the cases which are referred for treatment are the least favorable. There are also some who are so poorly informed that they believe that irradiation may stimulate a malignant process, in spite of numerous clinical and experimental reports and evidences to the contrary. The very fact that recurrences do appear after thorough postoperative roentgen therapy for cancer of the breast at once indicates that resistant neoplastic cells have remained after operation for which the surgeon must assume the entire responsibility, because irradiation has not the magic power to spontaneously germinate seeds of cancer in a field where none have previously existed.

Radiologists and others cannot reasonably expect favorable results in every instance. Unfortunately, there are many patients who might be benefited by radiation who are still denied even this possibility. However, I know of no basis on which we can determine which cases will be benefited without trial in each case.

Radiation therapy, as it is understood today, consists of the application of radium and roentgen rays in accurately measured and predetermined dosage in the proper location according to the individual indications. There can be no routine inelastic procedure. It is not only desirable, but essential, that each patient in whom a malignant disease is present should have the benefit of consultation and cooperation between the surgeon and the radiologist, each of whom is familiar with the technical details and the results of the other's method of treatment, as well as the limitations of his own. Thus, it must be decided whether the patient should be operated upon, whether preoperative or postoperative roentgen therapy, or both, should be utilized or if radium should be applied, and when and how, or whether radium should be combined with roentgen radiation.

This discussion is limited to postoperative roentgen therapy and therefore other therapeutic procedures are not considered. A report is presented of a series of 103 consecutive cases of patients who were operated upon and received roentgen therapy immediately postoperatively, during the years from 1922 to 1925 inclusive. I have not included those cases which were referred during this period for roentgen treatment of recurrences or metastases or those which were considered to be too far advanced to be operated upon, or those treated by other procedures. Each case has had microscopic confirmation of the diagnosis. The final outcome is not known in 8 cases but these are listed as dead at the time of last observation (see Table 1).

It will be noted that in 4 cases in the series bilateral carcinomata of the breast were present. In these cases it cannot be determined whether or not the disease in the second breast was a metastatic or a new cancer. Since these patients were free from the disease for over five years, they may be given credit for the period during which they were free; however, in classifying them I have included the individual tumors in all but the mortality statistics.

Ten patients in this series died of diseases which were proved not to be cancer. If they lived for five or more years, and were free from evidence of malignant disease, they are given the benefit of their period of life without cancer. I believe this to be a fair method, especially since the untraced patients are included among the dead.

The cases were grouped according to the extent of involvement. In Group I the patients were free from involvement of the axilla as reported by the pathologist. In Group II there was axillary involvement,

TABLE I

SUMMARY OF 103 CONSECUTIVE CASES OF BREAST CANCER TREATED BY POSTOPERATIVE ROENTGEN THERAPY

Group		No. cases	Skin invol.	Tumor fixed	Clin. axil. nodes	Clin. supcl. nodes	Recurrences	Metastases	No trace	Died not ca.	Died of ca.	Alive 5 yr. with ca.	Alive 5 yr. no ca.	Alive 5 yr. with or without ca.
I	No.	3 Bilat. 2	3	0	2	0	0	2 2 Bilat?	0	1	0	2 Bilat 0/2	6	7
	%		33.3	0	2.2	0	0	0	0	1.1	0	2.2	66.6	77.8
II	No.	64 Bilat. 2	35	21	40	0	13	17	6	8	17	2 Bilat 7/2	35	39
	%		54.8	32.8	62.5	0	20.3	26.6	19.4	12.5	26.6	10.9	56.3	61.0
III	No.	32	30	23	31	10	14	27	2	1	27	1	2	6
	%		93.7	72.0	96.9	31.3	43.7	84.4	6.3	3.1	84.4	3.1	6.2	18.7
All Cases	No.	103 Bilat. 4	69	44	73	10	27	44	8	10	44	8/5d	44	52
	%		67.0	42.7	71.8	9.7	26.2	42.7	7.8	9.7	42.7	7.8	42.7	50.5

minimum skin involvement and the tumors were movable. In Group III the cases were more advanced but still were considered by the surgeon to be operable. It is shown that of the patients in Group I, 77.8 per cent are now free from cancer. Of those in Group II, 61 per cent lived for five or more years and 56.3 are free from the disease. However of those in Group III, 84.4 per cent died of cancer and only 18.7 per cent lived for five years.

When all of the cases are included as one group it is found that 50.5 per cent lived for five or more years and 42.7 per cent are free from disease for five or more years.

The numerous reports in the literature regarding the results of operation alone for cancer of the breast indicate that not more than an average of 30 per cent of cases so treated are free from the disease after five years. If we compare the results in the series of cases which I am reporting here in which almost 43 per cent are free from the disease after only roentgen therapy as an adjunct to operation, we must appreciate the fact that there is some advantage to be gained by the procedure.*

* For discussion see page 556.

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THE TREATMENT OF METASTATIC AND INOPERABLE MAMMARY CANCER

WITH A DISCUSSION OF CERTAIN DISTINCT TYPES OF METASTASIS*

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THE study herein reported is confined to the treatment of primary inoperable, recurrent inoperable and metastatic cancer of the breast. Both the primary operable and the recurrent operable groups are excluded. In brief, it is a study of various methods employed in the treatment and management of the so-called "hopeless" case. It is recognized by those familiar with the results of radical mastectomy for cases of operable breast cancer that the five year "cures" are about 35 per cent —only one in every third case. This obtains in the surgical clinics which possess unquestioned pathological interpretations and careful follow-up records. The large group in this study is therefore composed of first, the 65 per cent of the previously primary operable cases that have recurred, and second, the primary inoperable cases —those that have either neglected their illness to the point where surgical interference is too late or those who possess the type not amenable to surgical interference from the beginning, such as the inflammatory carcinoma.[6] The appalling number of recurrrent cases, together with that large number who go to the physician for the first time to find it too late for a cure, offers a problem in *management* which ranks in importance next to the problem of how to cure the patient who comes early bringing with her a chance of cure. What can be done for this, the *largest*, group of mammary cancer sufferers? The answer to this question is dependent on whether the problem is that of (*a*) local recurrence; (*b*) extension from the original site; (*c*) metastasis, or (*d*) the *sequelae* of the recurrence or metastasis. The chief therapeutic armamentaria available for treating these cases are the following:

1. Irradiation
   (*a*) External, by roentgen rays, radium packs, trays, etc.
   (*b*) Interstitial, by the element or radon seeds, wires, needles, etc.
2. Surgery
   (*a*) For palliation, especially excision of the sloughing, necrotic, foul-smelling tissue.
   (*b*) For removal of local recurrence—this should be rarely employed as external irradiation is usually preferable.
3. Electrocoagulation
   This is especially valuable for the recurrent local skin nodules of the chest wall.
4. Medication.
   Certain drugs and chemicals assist in the process of bone repair such as irradiated ergosterol, cod-liver oil, phosphorus, and calcium lactate.
5. Plaster-of-Paris jackets.
   This supporting apparatus transfers the body weight from the crushed body of the vertebrae to the alae of the ilium.
6. The use of various surgical operations such as Kondoleon's operation or Handley's lymphangioplasty for the relief of lymphedema of the arm. Although lymphedema in cancer cases is commonly due to other causes it is frequently the result of recurrent disease in the axilla causing the lymph stagnation of the arm.
7. Cordotomy.
   An operation which consists of cutting the pain-tracks of the spinal cord which lead to the affected area.

* Read in the Symposium on Carcinoma of the Breast at the Sixteenth Annual Meeting, American Radium Society, Philadelphia, Pa., June 8–9, 1931.

Consideration will here be given to recurrence and metastasis to some of the more common sites. Certain types of recurrence or metastasis and their treatment will be mentioned. It must be emphasized that the treatment of recurrent and metastatic cancer is beyond the ability of any one physician. It is a task which requires the closest and most cordial cooperation between the radiologist and clinician responsible for the management of the case.*

In a recent address before the New York Surgical Society[2] we reported the results of studies made on the *operable* breast cases at the Memorial Hospital during the decade 1916–1926. Some cases had been under observation as long as fourteen years. Table I gives the results of the various types of treatment in this study:

Table I

TREATMENT RESULTS—FIVE YEARS OR MORE

	Number	Died of other Diseases	Basis of Calculation	Number Living	Per cent Living	Died of Cancer	Per cent	Living with Disease	Per cent	Living without Disease	Per cent
Surgery (alone)	23	3	20	2	10.0	18	90.0	0	0	2	10.0
Irradiation (alone)	37	4	33	12	36.3	21	63.3	4	12.1	8	24.2
Combined (surgery and irradiation)	137	9	128	52	40.6	85	66.4	3	2.3	49	38.2

It is gratifying and encouraging to find that 36.3 per cent of these cases treated by irradiation alone have lived five years or more. It gives us renewed faith and stimulates us to continue with increased confidence in the treatment by irradiation methods.

METASTASIS TO THE AXILLA

To my mind the most outstanding problem of breast cancer is the question of how to successfully treat the axilla. It is the only area of metastasis where we may still hope to obtain a cure after metastasis has occurred. As was stated above, the *operable* cases (those having cancer only in the breast or those with cancer in the breast as well as the axilla) *average* about 35 per cent five-year cures by surgery alone. As would be expected, this figure varies widely with the different authors. Table II quotes some of the results from Pfahler and Parry's article.[9]

Bloodgood's figures will probably represent a good cross-section of surgical results in America; namely, 70 per cent five-year cures in those cases having no axillary involvement, and 20 per cent in those having definite axillary disease. He has gone a step further than most in the study of the axillary material removed. He draws an imaginary line between the outer, middle and inner thirds of the axillary contents. His microscopic studies reveal that there were 25 per cent five-year cures where the outer (lower) third was involved; 15 per cent of those cases with the middle third involved, and only 10 per cent cures for the inner third. It brings out clearly the importance of the exact site of metastasis into the axilla. This type of study could better be done by the operating surgeon than the pathologist because the axillary contents are torn, distorted and misplaced by the time the material reaches the laboratory. In fact, it is

* In the Breast Service at the Memorial Hospital, of which Dr. Burton J. Lee is Director, we enjoy the enthusiastic cooperation of Dr. Herendeen, Chief of the Roentgenological Service, not only for his many film interpretations, but also for his therapeutic suggestions and the technical administrations of the roentgen-ray treatments. We are glad to acknowledge our indebtedness.

next to impossible for the pathologist to reconstruct the contents of the axilla for such a type of study.

Table II

RESULTS OF OPERATION IN CARCINOMA OF THE BREAST WITHOUT IRRADIATION AND WITH IRRADIATION

Author	Without Gland Involvement		With Gland Involvement	
	Operation without Irradiation: per cent	Operation with Irradiation: per cent	Operation without Irradiation: per cent	Operation with Irradiation: per cent
König	100		39	
Bloodgood	70		20	
Döderlein		80		36
Wintz		77		—
Pfahler and Parry		89		47
Schreiner		65		23
Schmitz		64		42
White	70			
Sistrunk and McCarty	63			
Greenough and Simmons	56			

In an analysis made by White[11] on 195 operable cases at the Roosevelt Hospital, he found 77 cases (38 per cent) with palpable lymph nodes; 109 cases (51 per cent) with axillary metastases. This study confirms a contention of mine of many years' standing, that it is *not possible* for any clinician to state with any degree of certainty whether or not the axilla is involved unless the nodes are comparatively large.

It takes more than a casual routine examination on the part of the pathologist to determine whether or not the axilla is involved. It is necessary for him to examine *several* nodes microscopically. Since experience teaches us that 45 to 55 per cent of even the operable cases have involved axillae, I am impressed not quite so much by the exact determination of the destructive dose for cancer while still in the breast, important though that observation is (10 to 12 S.E.D.), as I would be by the greater and more difficult task of determining the exact killing dose of cancer in the axilla. Here the problem is tremendously complicated on account of: (*a*) the axilla being a large fat-filled cavity; (*b*) this fat per se having little blood supply; (*c*) the fact that radiosensitivity so directly depends on the blood supply of the tumor bed; (*d*) the presence of the unusually large vessels—the axillary vein and artery, and (*e*) the proximity of the brachial plexus.

Since making a visit to Sampson Handley's Clinic nine years ago, I have used at the time of operation, bare tubes and gold seeds in those cases having involvement of the axilla. We are convinced of their usefulness in helping to control axillary disease. One can place a row or barrier of the seeds along the vein, beginning near the sternoclavicular junction, spacing them 1 cm. apart, not going nearer to the axillary vein than 0.5 cm. The technical problem of having a holder or bed for the radium seeds arises after a clean removal of the axillary contents. About the only tissue holder available after the dissection is the posterior surface of the clavicular portion of the pectoralis major muscle; however, it is possible to insert across the length of the axilla a row of seeds high up superficially in the intercostal muscles. This gives two rows to act as a barrier against upward extension of disease into the supraclavicular space. It also destroys local carcinoma cells which may remain behind after operation.

The axillary space is very large and the accurate placement of radon without opening the axilla is difficult, but I think that implantation can be much more accurately accomplished than is usually done. The technique is simple, though it may seem bold to some. The patient is placed on the table under gas and oxygen anesthesia, the arm is held at an exact right angle to the body, an assistant presses one finger (preferably the third finger because it is longer) upward over the axillary vein as it crosses to the arm. This pressure will push the vein

upward so that it is in less danger of being punctured. A tiny hole is made just through the integument of the axilla in the mid-axillary line with a No. 12 Bard-Parker blade to avoid the "clinging" of the skin to the needle containing the radon seeds or wires. By measuring the length from the base of the axilla (the skin) to the sternoclavicular joint, one may estimate the number of radon seeds necessary to form the barrier. Using the same puncture opening to insert all the seeds, one can "feel his way" with the needle along the outward curve of the upper ribs, and the seeds can be fairly accurately placed not only in reference to the vein but also in relation to each other. This same technical principle applies to the insertion of the Pack radon wires, the element needles of Geoffrey Keynes and the platinum breast needles devised by Failla. These long needles and wires, varying in length from 3 to 10 cm., should be inserted and distributed in a fan shape. The determination of the exact formula for obtaining the lethal dose of axillary disease in the face of so many variables becomes almost an insurmountable problem in comparison with that in the breast where we can determine where the disease is and its exact size. It is not possible to determine the extent or the position of invaded axillary nodes before operation. There may be no clinical evidence of axillary involvement but at operation we frequently find a group of nodes tucked behind the pectoralis minor muscle lying on the axillary vein when such was not palpated or anticipated. Any attempt to accurately irradiate the large pyramid-axillary space is impossible. However, diffuse and effective irradiation may be administered throughout the axilla, even though it is not possible to exactly measure the amount delivered into a chain or scattered groups of involved nodes when employing interstitial irradiation. The type of long applicators, well placed through the large axillary space, will deliver more diffuse radiation than the seeds. With these longer needles or wires the source of radiation is also removable, which is not true of the seeds, so that when the desired dose has been given they may be removed. If a radon seed were to be placed too close to, or by muscular action brought into too close contact with, the brachial plexus, nothing can be done to relieve the intense brachial neuritis. Incidentally, I doubt if the axilla will withstand the 10 to 12 S.E.D. which the breast receives. It unquestionably would produce a distressingly severe neuritis.

The interstital irradiation should always be fortified by a high voltage roentgen-ray cycle. It will be interesting to observe the results of carrying out Dr. Duffy's suggestion of utilizing the five portals for external irradiation of the axilla. It may be possible that the axillary skin will withstand the delivery of 250 to 300 per cent S.E.D. into the center of the axillary chain of disease. One such case recently operated upon showed most profound radiation changes in the axillary tissue. This, combined with interstitial irradiation utilizing some such method as above outlined, may make it possible to diffuse 600 or 700 per cent S.E.D. throughout the axillary space without doing serious damage to the brachial plexus. Experience may ultimately show that the axillary disease does not require the same 10 to 12 S.E.D., as determined by Lee and Pack,[7] for the lethal dose of cancer while still domiciled in the mammary organ. We have yet to learn the results of treatment of the axilla as well as the breast by some such method as that used by Regaud and Coutard in their cases of carcinomatous cervical nodes. This is a method of delivering about one-third of a skin erythema dose daily through various portals until a dose of 500 or 600 per cent is delivered. We have commenced this method at the Memorial Hospital in a few selected cases but cannot as yet render an opinion as to its efficiency.

In general, our experience has taught that axillary disease reacts in one of three ways to irradiation:

1. Complete clinical disappearance of disease by external irradiation. This type

is rather rare even in the very radiosensitive tumors.

2. No clinical effect on the axillary disease by the employment of external or interstitial irradiation, or both.

3. No clinical effect by external irradiation alone, but by the addition of interstitial, a complete disappearance of the disease. This type occurs more frequently than is generally believed. A good example of the latter type is shown by the following case report:[1]

S. Z., female, aged thirty-four. On admission to the Breast Clinic, December 31, 1928, the disease was classified as primary inoperable mammary cancer, on account of its being metastatic to the axilla and to the supraclavicular region. The patient was given a high voltage roentgen cycle of four treatments, two of which were directed into the axilla, the last being given Jan. 7, 1929. Following this treatment (Jan. 27, 1929) the patient was given 14,000 mc-hr. by radium element pack over the axilla. One month later the supraclavicular nodes and the breast disease had disappeared. The axillary disease was slightly diminished in volume but still persisted. On Aug. 15, 1929, 21 mc. of radon were placed in the axilla in gold seeds. Two months later there was complete disappearance of the axillary mass and to date, Jan. 1, 1931, twenty-two and one-half months afterwards, there has never been any recurrence of a previously bulky axillary mass. The pathological report was "cellular adenocarcinoma."

This case is one in which external irradiation was sufficient to dissipate the supraclavicular and the breast carcinoma, but it required the additional interstitial irradiation to cause the axillary disease to disappear.

There is definitely a field in the treatment of axillary cancer for the exact placing and utilization of buried emanation by radon wires, platinum needles, radon seeds and element needles. They should, however, not be employed as a preoperative measure. Their fields are restricted to (*a*) the laying of a barrier at the time of the operation and (*b*) the use of these agents in the inoperable cases. We must determine what the brachial plexus will withstand as to quantity of irradiation. My impression is that the very best form of interstital axillary irradiation is the needles containing the element—not in large amounts but in small amounts of from 5 to 10 milligrams each—remaining in situ until the required dose is delivered, then removed. By using four such axillary needles scattered from the apex to the base of the axilla, a diffuse irradiation may be delivered over a period of several days. My only objection to the Pack wires and the platinum radon needles is that they have a peakload of intensity which is conducive to neuritis unless very accurately placed.

METASTASIS INTO THE SUPRACLAVICULAR SPACE

The problem of irradiating the supraclavicular region, although very different, is at the same time very similar to that of the axilla in that the brachial plexus is again the structure which deters us from utilizing intense doses. From the practical viewpoint one may consider the supraclavicular space as an extension of the axillary space upward, behind and above the clavicle. By the time there is extension of axillary disease into the supraclavicular space it frequently happens that the roentgenogram of the chest will reveal carcinomatous infiltration into the lung parenchyma, and at this stage it is not best to make a too strenuous effort to cure supraclavicular disease. However, this is not always true. The degree of zeal of one's effort to cure must be dependent upon the type of metastasis. In our experience there are three distinct types of supraclavicular involvement:

1. The most common type met clinically is that in which the upper half of an 8 to 10 mm. node is palpable immediately above the middle of the clavicle. This "signal node of breast carcinoma" is not in the position of the "signal node of gastric cancer." It lies further laterally. Freqently this node develops slowly over a considerable period of time, while the disease in general is making progress more rapidly in

other parts. It is this type of case with a slowly growing supraclavicular node that has had repeated irradiation in the attempt to cure the supraclavicular disease, with resultant skin damage and rarely even exposure of the clavicle. On account of the various ways that skin reacts to irradiation, it is difficult to determine the exact threshold beyond which no more irradiation should be applied. Only by a study of our *average* case can any conclusion be drawn as to tolerance of the clavicle or the skin of the neck. The clavicle lies immediately beneath the skin in a protruding manner, having almost no subcutaneous fat between it and the skin. The bone is therefore poorly protected from irradiation. In general, the routine for the irradiation of our breast cases is a preoperative high voltage roentgen-ray cycle, a similar postoperative cycle one month after operation, a repetition of this cycle at the end of three months and the fourth and last cycle about four or five months later. This means that the clavicle receives irradiation from each of the four treatments directed over the base toward the apex of the axilla; and also four more treatments directed anteroposteriorly which includes the supraclavicular and the infraclavicular regions as well as the upper chest wall. The clavicle therefore routinely receives eight treatments. Under this *routine of eight high voltage roentgen treatments* we practically never observe damage to the bone. Time alone will reveal the late effects caused by such irradiation, more especially as to fragility, and the production of radiation osteitis and necrosis. The skin of the supraclavicular region withstands this amount of irradiation without causing permanent ulceration. There are but two cases of exposure of the clavicle in the entire breast clinic, and many cases have received much more than the eight routine treatments. The record of the following case shows that the patient received enormous quantities of irradiation —much more than our routine.

A. T., female, aged forty-three. Admitted to the Memorial Hospital Breast Clinic, December 31, 1922, having had a radical mastectomy four months previously for scirrhous carcinoma. On admission she showed evidence of recurrence just above the right clavicle. She complained of pain in the right shoulder and arm. The radiation treatments covering a period extending from January 1, 1924, to August 10, 1927 (three years and eight months), consisted of two low voltage and five high voltage roentgen treatments over the supraclavicular region; two low voltage and four high voltage treatments over the axilla; four treatments by radium packs varying from 10,000 to 14,000 mc-hr. This made a total of thirteen treatments by roentgen rays and four by radium packs. On September 24, 1928, there was some supraclavicular ulceration; two months later (four years since the first treatment and one year since her last treatment) the supraclavicular

Fig. 1. Showing a patient first treated eight and a half years ago by heavy irradiation for involvement of supraclavicular node. The clavicle has been exposed and ebonized for three years. The lymphedema is due to radiation fibrosis rather than recurrent disease. The patient is in good general condition, without evidence of any active carcinomatous process.

ulceration persisted and the clavicle was exposed over a small area. This area increased until the clavicle is now largely exposed (see Fig. 1).

Although the clavicle has been exposed for three years, a gratifying feature of this case is that the supraclavicular disease has been inactivated, and there is no clinical evidence of active carcinomatous disease. This patient has marked lymphedema of the arm, which is unquestionably due to the fibrosis following intense irradiation as there is no recurrence to account for the lymphedema.

In this type of supraclavicular metastasis we have on frequent occasions introduced interstitial irradiation in the form of bare tubes or gold seeds directly through the skin into the involved node without making any skin incision. This has given excellent results in many instances. However, most of them developed a brachial neuritis which was most distressing for a period of three to four months, the neuritis then gradually disappearing. A few cases developed painful neuritis which persisted for as long as two years so that we have given up the use of this form of applicator, believing the needle as used by Geoffrey Keynes to be preferable as it can be withdrawn ad lib.

Fig. 2. Showing lymphedema of face (left lower eyelid), infiltration into the left supraclavicular space, bulky infiltration of left breast evidenced by size and pigskin appearance (peau d'orange) in a very rapidly growing carcinoma of the breast—total duration of life after inception of the disease, about six months.

2. The second type is that in which there is direct extension of the axillary disease in chain-formation upward to the tip of the mastoid. The nodes are smaller than in the first type above described. The space immediately above the clavicle frequently seems matted and somewhat filled in with the same infiltrative process as the breast. Immediately above this area a chain of small nodes extends up to the mastoid. The patients give symptoms of a postauricular neuralgia due to pressure on the nerve. This type occurs invariably in cases of rapidly growing carcinoma. It happens at times that there is partial blockage of the cervical lymphatics even to the point of producing lymphedema of the face. The following brief report represents this type of case:

R. L., female, aged forty-eight, was admitted to the Memorial Hospital, April 9, 1923. She had noted a hardening of the left breast commencing two months previously. On physical examination it was revealed that a carcinoma was infiltrating the entire left breast, accompanied by bulky left axillary metastasis, and also metastasis into the left supraclavicular space, extending to the mastoid tip. There was slight lymphedema of the face, particularly evidenced by narrowing of the left palpebral opening and edema of the lower lid (see Fig. 2). The patient received radiation therapy but the rapidity of extension of the disease caused her death four months later.

Although external irradiation improves temporarily the local supraclavicular condition and especially the post-auricular pain from which they greatly suffer, the rule in this type is that the disease is advancing so rapidly into other portions of the body such as the opposite breast, the

chest, the bones, etc., that little is accomplished.

3. The third type represents a more uncommon group—that in which one or two quite large and discrete nodes are involved, usually occupying the position overlying the clavicular origin of the sternocleidomastoid muscle or immediately lateral to this space. In my experience there has been no instance where these superficial large nodes were situated as far laterally as the posterior belly of the omohyoid muscle. We have treated these cases by external irradiation with high voltage roentgen rays but relied chiefly for the cure on the introduction of radon in the form of bare tubes or gold seeds into these nodes. On account of the superficial position, the nodes are easily speared without incision, and therapy accomplished without much brachial neuritis. The following case illustrates an instance of this type of supraclavicular disease:

A female, aged thirty-nine, three years previously had a left radical mastectomy. During a period of five months before admission to the Memorial Hospital the patient developed two nodes, which gradually increased until each was 1.5 cm. in diameter. One lay on the clavicular origin of the sternocleidomastoid muscle and the other, separated by a distance of 8 mm., lay lateral to the first. Each node was speared with two bare tubes containing 1.5 mc. When the patient was next seen two weeks later the nodes had diminished to one-third their former size. One month later there was complete disappearance of disease. Three years later the patient developed a carcinoma of the cervix, was operated on by her physician for this condition, and died one year later of pelvic extension from the cervical cancer. At the time of her death, four years after treatment by interstitial irradiation of the neck nodes, the patient had never developed any local recurrence.

This group is successfully treated by interstitial irradiation fortified by external irradiation.

In general, external irradiation is the most satisfactory form employed in treating the supraclavicular space. It is only the rare case that is amenable to interstitial irradiation, unless the radon or the element is in a form that can be removed. We believe that there is a more frequent clinical disappearance of supraclavicular disease by an equal dose of external irradiation than is obtained by the identical dose in the treatment of axillary disease. This may possibly be due to the more superficial position of the supraclavicular disease. Much will depend on the grade of malignancy of the tumor. It is not at all uncommon to get a complete clinical disappearance of supraclavicular disease by two high voltage roentgen treatments or a single application of the radium pack for about 20,000 mc-hr.

METASTASIS INTO THE BRACHIAL PLEXUS

In the Breast Clinic which averages approximately 550 new cases per year (during 1930 there were 567) we annually receive from 2 to 4 cases of carcinomatous invasion of the brachial plexus which present a most baffling problem. The cases are typical as to facial expression, position of the affected shoulder, inability to obtain relief from the intense pain, atrophy of the hand, painful arm, increasing paralysis of the hand muscles and dusky color of the hand. Any clinician who has ever observed one case will always recognize such a condition. The chief complaint of the patients is *pain*, so severe, and so intractable that they actually go for nights in succession without sleep. The haggard expression of the face is that of great "weariness" from pain and loss of sleep. Morphine even in large amounts fails to produce sleep. The shoulder is held high (see Figs. 3 and 4) due to the levator anguli scapulae muscle. Even the trapezius muscle seems to stand out as if in spasm. This occasionally produces an artificial appearance of a large depression in the supraclavicular fossa—when as a matter of fact the fossa is more filled than usual. The entire arm, shoulder and hand are painful and stiff. The arm is usually enlarged because the axillary disease impedes the lymph return of the arm. There

Fig. 3. Showing typical position of holding the shoulder in a case of carcinomatous infiltration of the brachial plexus. The affected arm is always held close to the body. There is marked atrophy of the forearm and hand muscles. A cordotomy was done on this patient with such relief of symptoms that she ceased taking hypnotics.

is marked atrophy of the thumb (see Fig. 5) and interosseous muscles. External irradiation by radium packs, trays, high voltage and low voltage roentgen rays, have all consistently failed to improve the condition or bring any relief from pain. The introduction of interstitial irradiation cannot be entertained. The only treatment which has offered relief from the excruciating pain has been cordotomy. Dr. Byron Stookey has been consulted many times concerning this group and he has performed cordotomy on 3 such cases. The operative risk is great on account of the high position in the neck at which level the pain tracts are severed. As yet there have been no fatalities among our cases so operated. It has not always meant a complete cessation from pain but the improvement is so very striking that the procedure is not only justified but our *only* recourse to obtain relief. Dr. Stookey[10] is the only neurological surgeon who performs cordotomy at such a high level. He is proceeding cautiously with this work and as yet sees no contraindication to the performance of the operation.

Grant,[5] in a recent article on the subject of cordotomy, makes the following statement:

> Cordotomy has three distinct advantages over the older methods of relieving pain. Firstly a greater degree of anesthesia can be produced by section of the antero-lateral pathways than by any other means; secondly, pain and temperature sensations alone are obliterated without involvement of touch or position sense and hence motor function remains unimpaired; lastly, the operative procedure requires only a small laminectomy and is, therefore, much less exhausting to debilitated patients. . . . It seems obvious that this suggestion of Spiller's for relieving intractable pain by section of the antero-lateral columns of the spinal cord is a practicable, justifiable and merciful procedure.

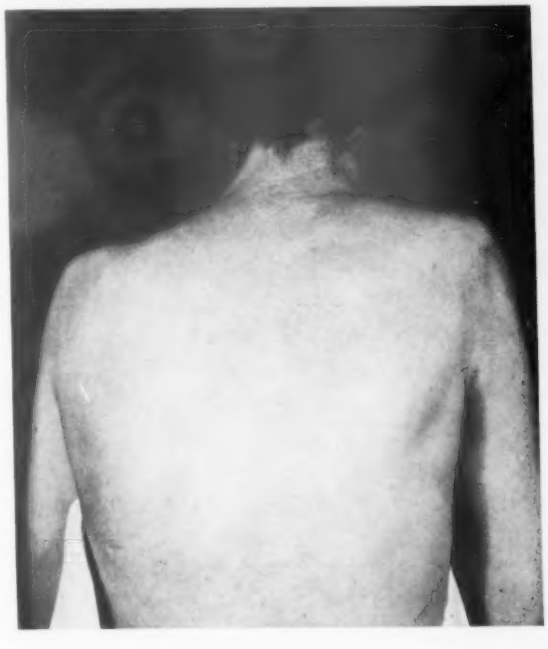

Fig. 4. Showing posterior view of the shoulder of another patient who had the elevated shoulder typical of infiltration of the brachial plexus with carcinoma.

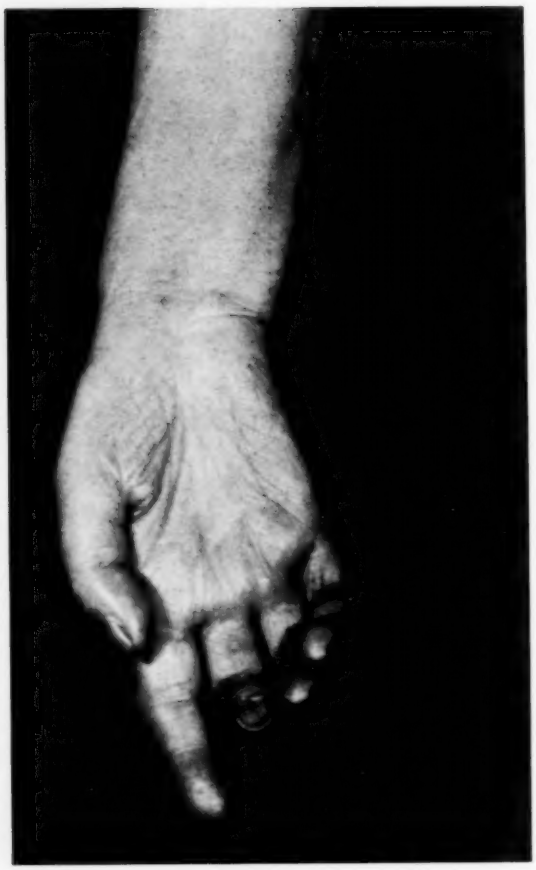

Fig. 5. Showing the affected hand in a case typical of carcinomatous invasion of the brachial plexus. The muscles of the thenar eminence are markedly atrophied as are the interosseous muscles. The hand is a dusky color secondary to partial obstruction of the axillary vein by surrounding disease.

METASTASIS TO THE PARASTERNAL SITE

It is common to see a bulky metastasis to the parasternal position. This group of cases brings to irradiation one of its most brilliant opportunities. Never have we seen *proper* irradiation fail to care for such a metastatic mass. Surgery cannot be employed as it would be necessary in removing such a mass to excise a large area of chest wall including ribs, a portion of the sternum, muscles, etc., leaving a gaping hole leading to the mediastinum. The uniformly good results of heavy irradiation of parasternal disease may possibly be accounted for because the lesion is superficial and accessible. An example of such a case is the following:

M. C., female, aged forty-three, was operated on at Bellevue Hospital for mammary carcinoma. A radical mastectomy was performed July, 1920. Six months before admission to the Memorial Hospital, March 10, 1922, a bulky mass developed beside the sternum. Dr. Ewing's report was "cellular sweat-gland carcinoma." A radium pack of 10,000 mc-hr. was applied and this was followed by one low voltage roentgen treatment. By the end of the month the mass had completely disappeared. The mass never recurred although the patient received no more treatment. Three years later the patient died of an intercurrent disease.

There is one definite contraindication to the treatment of these cases, namely, ulceration of the lesion. The following case illustrates this point:

S. F. (see Fig. 6), female, aged sixty-four, was sent from the Roosevelt Hospital by Dr.

Fig. 6. Showing the ulceration of a parasternal mass. The ulceration contraindicates the use of large amounts of external irradiation, applied at one time (see Case S. F.).

Fig. 7. Showing typical parasternal recurrent mass before treatment, July 27, 1927.

Fig. 8. The same case as shown in Figure 7 seven months later (February 20, 1928) after treatment by external irradiation had been applied. There is complete clinical disappearance of the tumor mass.

William C. White on account of having a solitary, bulky, ulcerating recurrence beside the sternum. At the clinic a radium pack of 15,000 mc-hr. was placed over the lesion. Six weeks later the patient died as a result of a hole in the chest wall exposing the mediastinum at this site. The lesion had invaded the chest wall which was thin from necrosis and infection, and the irradiation probably caused further destruction locally. It is probable that very light or divided doses of radiation scattered over some period might have produced sufficient fibrosis to avert this disaster.

Such a remarkable disappearance of disease as in case M.C. above can usually be promised. In a review of 10 such cases (see Figs. 7 and 8) the local disease has never failed to disappear. It has occasionally been necessary to give more treatment later because either the disease did not entirely disappear or usually the second series of radium packs or high voltage or both is sufficient to permanently stop the growth.

In our series of 10 such cases one radium pack of 15,000 mc-hr. followed by one high voltage roentgen treatment cured the local disease in 6 cases, but in the other 4 patients it was necessary to repeat this dose. Even in those instances in which the lateral border of the sternum showed destruction and invasion of bone, proper irradiation gave remarkable bone repair changes.

Metastasis to the Osseous System

It is commonly considered when metastasis has taken place into the osseous system that no therapy of any type is capable of materially benefiting the patient. Ewing[3] states: "The location or bed of the tumor has much influence on the results of radiation. Everyone is familiar with the resistance of tumors growing in bone." To quote him again: "The higher resistance of

malignant tumors invading bone or cartilage is well known."[4]

On observing some very striking results in certain instances of bone metastasis from breast cancer some years ago, I have been forced to change my viewpoint on the subject of treatment of metastasis to bone. In fact, today I believe it is possible to offer the patient a definite promise of striking improvement if the management of the case is carried out by a combination of exact irradiation and skeletal support where necessary.

Although it is difficult to estimate the exact benefit derived from the administration of drugs which are of theoretical benefit in cases of pathological fracture and bony destruction from metastasis, the evidence is gradually piling up and being widely accepted that bone repair takes place more quickly if the patient receives irradiated ergosterol, cod-liver oil, and calcium lactate. The active principle of cod-liver oil is available on the market from the manufacturing chemists.

It has been observed by many that one frequently sees wide bone metastasis without metastasis into the lungs. Wood[12] has recently called attention to this point. Lenz and Freid[8] have recently stated that 16 per cent of their cases had metastasis into the osseous system.

METASTASIS TO THE SPINE

The lumbosacral region seems to be the most frequent site of metastasis to the spine. The symptoms are typical, being those of local pain over the affected vertebrae, local tenderness on pressure and pains radiating around the body to the mid-abdomen. There are two main clinical types of metastasis into the spine:

1. The type in which there are numerous foci scattered through many vertebrae. It is usually accompanied by a wide metastasis to the pelvis, femora, ribs, scapula, etc. Many of the areas later become confluent. This group occurs usually in the very cellular, rapidly growing, highly malignant type of breast tumor. The prognosis from the standpoint of temporary improvement by irradiation is good. The eventual prognosis is very grave.

2. The other type of spine metastasis is that of a single metastasis into the body of a vertebra (see Fig. 9). The weight of the upper half of the human frame eventually crushes the affected body of the vertebra, causing intense pain by pressure on the cord and on the nerves which emerge from the cord at this level. Some striking results are secured in this type of case by supporting the upper half of the body in a plaster-of-Paris jacket, transferring the weight to the ala of the pelvis. During this time the patient is receiving external irradiation through a window in the cast. Bone repair follows and these patients receive extraordinary relief by this method. In order to apply the cast it is best to suspend the patient from the occiput and chin.

Fig. 9. Showing the eighth thoracic vertebra crushed. Patient R. P. was unable to walk. Marked pain locally and radiating around to the abdomen. Following two high voltage roentgen treatments, the crushed body of the vertebra has undergone repair. It is now dense bone. The patient walks without pain. Local pain has disappeared.

Much depends on the general condition of the patient as to the filling in of the destroyed bone by products of repair. In general, the better condition the patient is in, the more opportunity for a successful bone repair. We have known of instances where patients had been bedridden for several months with metastasis into the spine from breast cancer, but who, under the combined treatment of using the supporting jacket and deep treatment by external irradiation have not only been made free of pain but have regained the lost power of locomotion. In one such instance this remarkable result was obtained by two high voltage roentgen treatments over the crushed vertebra. The chief difficulty in the management of such cases, as I view it, is that the feeling of hopelessness is so well established in the mind of the clinician that he will make no special effort. One must frequently check up on the repair process by numerous roentgenograms in order to know when more treatment is indicated. Only by frequent check-ups will we eventually work out a definite plan of therapy. There is a large field for research in utilizing the varying factors of external irradiation. I have an optimistic belief in the future of irradiation of metastatic bone disease if and when it is accurately and correctly applied.

METASTASIS INTO THE PELVIS

Although Lenz believes that lumbosacral spinal metastasis ranks first, the femur second and the pelvis third in osseous metastasis, my impression is that the spine is first and the pelvis second. When both pelvis and femora are involved at the same time, it is impossible to determine by roentgen examination which was the one first involved.

The symptoms manifested are entirely dependent on the position of the metastasis into the pelvic bone. Metastasis into the ala causes comparatively few symptoms until it becomes rather large. Metastases occurring lower in the bone have more pronounced manifestations. When a patient complains of symptoms varying from vague discomfort to definite hip joint pains, with occasional darting pains down the thigh, centering especially in the knee of the affected side, the clinician may be sure of metastasis not into the femur but into the pelvis near the acetabulum. On numerous occasions a positive diagnosis has been made of almost the exact location of metastasis from the symptoms. There seem to be two clinical types of pelvic metastasis:

1. The solitary, irregular, destructive type, having a moth-eaten appearance on the roentgenogram. The affected area gradually grows until it may become wide. It requires more irradiation to effect bone repair than type 2 below. As a rule, this is a more slowly growing type.

2. In this type there are multiple, rounded, discrete foci, producing complete destruction of the areas involved. There is a clean-cut, sharp outline of the lesion as if a large missile had completely taken away every vestige of bone from this area. These areas vary in size from 3 to 5 cm.

An example of the first type is recorded in the following case:

E. B., female, aged thirty-two, entered Memorial Hospital Clinic, April 2, 1927. She had been operated on at St. Marks Hospital, January 3, 1927, by Dr. Benjamin Tilton, for a cancer of the breast. Pathological diagnosis was "adenocarcinoma". During October, 1927, the patient received two high voltage treatments over the left supraclavicular space as she had developed supraclavicular metastasis. By February, 1928, the supraclavicular disease had disappeared. She remained free of disease until August, 1929, when she developed pain in the right *hip joint and left knee*. Roentgenograms of the left pelvis revealed a wide area of bone destruction (see Fig. 10), beginning in the pelvic brim, extending in all directions and including the acetabulum. The lumbar spine was negative. The patient was scarcely able to walk. She was given six high voltage roentgen treatments over the left ilium and cross-fired by three more over the right ilium. The treatments were completed September 28, 1929. On February 21, 1930, which was six

Fig. 10. Case E. B., showing a wide destructive metastasis into left pelvic bone on September 16, 1929, before the institution of treatment. Pain in hip and knee very severe. Patient scarcely able to walk across the room.

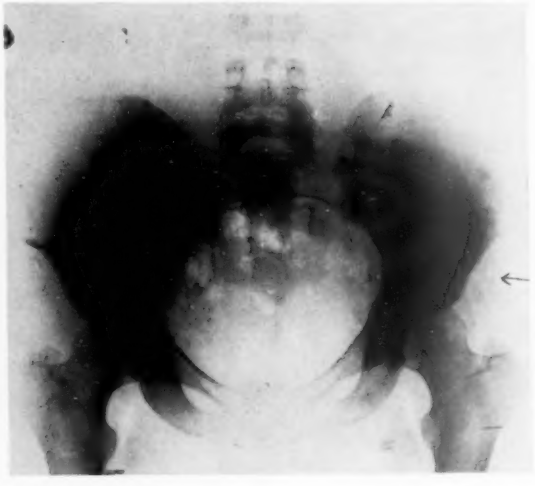

Fig. 11. Same case as in Figure 10 showing bone repair on February 21, 1930, five months after the beginning of high voltage irradiation. The destructive area is replaced with dense callus. The original contour is restored. The patient walks normally without pain, and works as a cook.

months after the roentgenogram was made which showed the destruction of the brim of the true pelvis, Dr. Herendeen made the following report: "Film of the pelvis made today, when compared with previous film, reveals evidence of a remarkable repair process in the left ilium. No evidence of active bone destruction seen." (See Fig. 11.) Following the treatment over the pelvis the pain and disability gradually disappeared. There was no evidence of recurrence of local bone disease until March, 1931, a year and a half after the first recurrence. On her recent visit to the clinic roentgenograms revealed a local recurrence or extension of the disease upward into the ala of the left pelvis where treatment had not been especially directed. In other words, the only evidence of cancer four years after her operation is in the left pelvic bone, not where she received intense treatment (as the films show that in this area dense bone still remains) but in the upper edge of the original metastatic process where she did not obtain sufficient irradiation.

Had the patient more fully cooperated it is probable that the recent pelvic recurrence would have been more promptly treated. It is of interest to speculate on what effect, if any, irradiation over the ovaries had in her repair process. As a rule, my impression is that the younger the subject, the more striking are the results of irradiation on the involved metastatic areas in bone. The more advanced ages do not afford such striking results but responses are seen. The above case demonstrates the great possibilities which lie in the field of irradiation of invaded bone. Even the original normal outlines of the bone were restored as the dense callus was laid down.

In the second type of metastasis, the repair process is equally striking but of a different nature. In this instance the repair takes place from the periphery of the clean-cut, punched out hole, toward the center, gradually filling it in with a dense callus as it proceeds. In some of the largest areas the center is never quite replaced by the callus.

Here is a clinical suggestion I believe of importance, namely, when a patient complains of symptoms which suggest bone involvement in either spine or pelvis, and the roentgen examination fails as yet to reveal evidence of disease, apply external irradiation over the suspected area without waiting for the roentgenogram to reveal bone destruction. A study of such cases over a period usually reveals that a disease proc-

ess eventually will be shown by the film. Therefore, treatment should be instigated from the inception of symptoms rather than delayed to the point where the roentgenogram shows marked bone invasion.

SUMMARY

1. Studies made of the inoperable or "hopeless" cases of cancer of the breast reveal that the metastases arrange themselves into definite class groups.

2. The best form of treatment of these cases depends upon the exact type of metastases.

3. The axilla offers a more difficult problem in thorough irradiation than does the breast on account of the proximity to the brachial plexus and the large axillary vessels.

4. More diffuse radiation is scattered throughout the axillary space by the use of the Pack radon wires, the platinum radon needles and the long element needles than by the use of bare tubes and gold seeds.

5. More irradiation is required to obtain disappearance of axillary disease than supraclavicular disease.

6. In only one type of supraclavicular metastasis is the use of bare tubes or gold seeds indicated.

7. The clavicle will withstand one routine exposure of eight high voltage roentgen treatments.

8. The use of cordotomy in cases of carcinomatous invasion of the brachial plexus is urged.

9. Bulky metastasis to the parasternal site is ordinarily dissipated by the routine use of one radium pack of 15,000 mc-hr. and one high voltage roentgen treatment.

10. The literature on this subject of metastasis into the osseous system implies the uselessness of attempting treatment. Well-planned irradiation, together with the use of proper supportive apparatus, not only gives great relief from pain but occasionally has given months of useful life to patients who were bedridden with paralysis of the legs from pressure on the spinal cord.

11. Properly planned irradiation as a rule will give improvement in function and symptoms in cases of metastasis into the pelvic bone.*

* For discussion see page 556.

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THE INTERSTITIAL USE OF GOLD-FILTERED RADON TRANSFIXION TUBES IN THE TREATMENT OF MAMMARY CANCER*

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Introductory Note—Interstitial irradiation at the Memorial Hospital has long been given by means of tiny irremovable gold-filtered radon seeds devised by Failla. In order to fulfill the need for linear foci of interstitial irradiation, I conceived of the employment of gold-filtered removable radon tubes many times the length of the original gold seeds. Radon is usually collected in hollow gold tubes with a wall thickness of 3/10 millimeter; the gold seeds are prepared by cutting these tubes into diminutive lengths. In consultation with Dr. Failla, physicist to the Memorial Hospital, concerning the use of these long gold tubes as interstitial sources of radiation rather than the tiny seeds prepared therefrom, it was found that he had also conceived of the same idea and had experimented in their manufacture. The present research was accomplished through the close cooperation of Dr. Failla to whom due credit should be given for his contribution.

PREVIOUS communications from the breast department of the Memorial Hospital presented in detail a new method of treating mammary cancer by measured tissue doses of radiation, delivered from external sources (roentgen rays, 4 gram radium pack) and by the interstitial deposition of gold radon seeds.[1,2] The cancericidal dose for various carcinomas by physical and clinical experimentation, has been determined, e.g., 8 to 10 S.E.D. (skin erythema dose) for intraoral epidermoid carcinoma[3] and 12 to 13 S.E.D. for carcinoma of the breast.[4] The depth dose which reaches the tumor from external sources of radiation is added to the interstitial dose given by gold radon seeds. Each tumor is considered as a sphere, the diameter of which is equal to the longest dimension of the tumor. The number of millicuries of radon in gold seeds necessary to give various skin erythema doses to spherical tumors of different dimensions has been carefully calculated by the physical department and tables prepared for the clinical utilization of these data. During the last eighteen months over 100 mammary cancers have been treated with moderate success by this method of combined external and interstitial irradiation.

The accurate placement of gold radon seeds in proper dosage can effect complete destruction of small mammary cancers (less than 6 cm. in diameter), as we have demonstrated by clinical experimentation and subsequent microscopical study of the breasts after amputation.

Certain handicaps to universal success with this method of irradiation were early recognized. The difficulty of accurate placement of point sources of radiation, as exemplified by the method of gold radon seed implantations, is particularly apparent in the treatment of tumors larger than 6 cm. in diameter and in treatment of outlying regions of the breast such as axilla, infraclavicular, supraclavicular, paramammary and epigastric regions. Roentgenograms of the breast and the drainage areas were frequently made following gold seed implantations; they furnished concrete evidence of the errors in the distribution of these gold seeds in large tumors and in the axilla. Amputated breasts containing large irradiated carcinomas together with axillary contents would sometimes show complete destruction of tumor for the most part, but persistent viable carcinoma in regions which by error had escaped interstitial irradiation. Or necrotic metastatic carcinoma would be found in in certain well-irradiated axillary lymph nodes, whereas other nodes untouched by and distant from the gold radon seeds in

* From the Breast Service of the Memorial Hospital, New York. Dr. Burton J. Lee, Attending Surgeon. Read in the Symposium on Carcinoma of the Breast at the Sixteenth Annual Meeting, American Radium Society, Philadelphia, Pa., June 8-9, 1931.

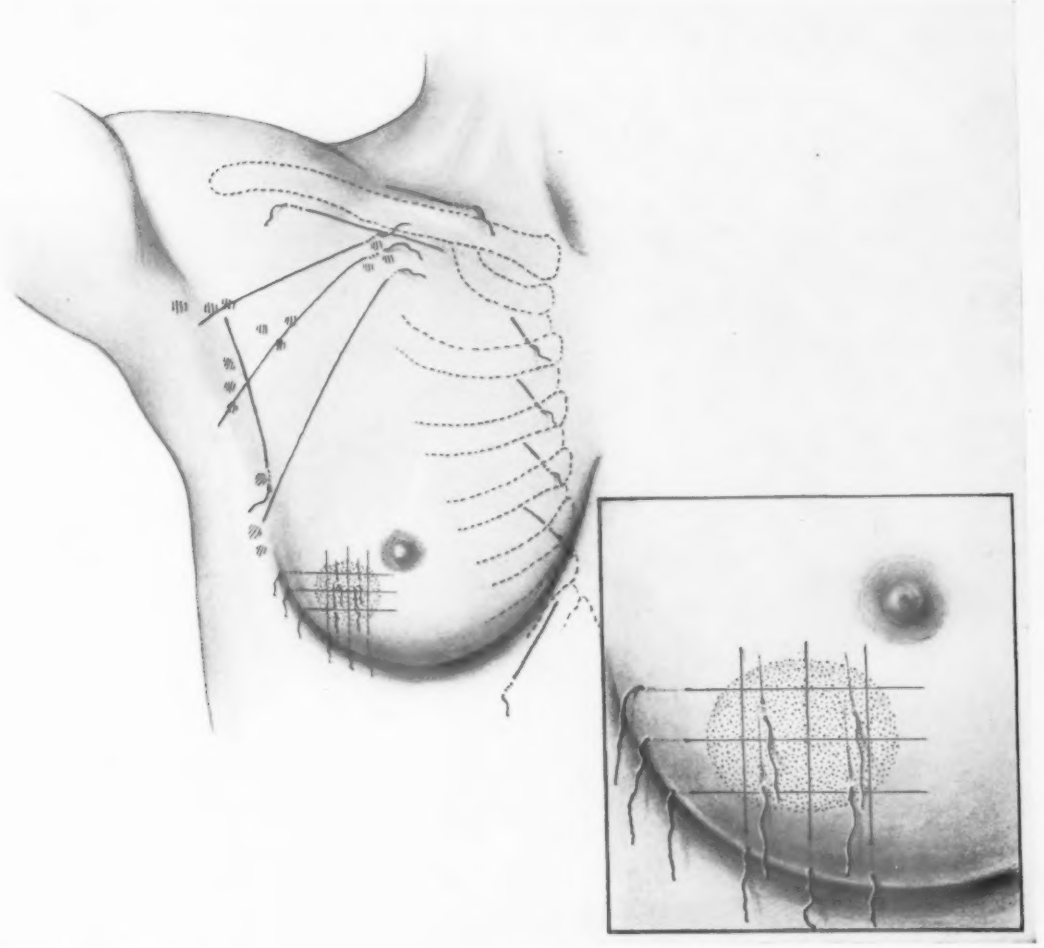

Fig. 1. The distribution of gold radon transfixion tubes in the breast, axilla and paramammary regions.

the axilla, would contain actively growing cancer. The quantity of radiant energy delivered by a gold radon seed (with 0.3 mm. Au filter) decreases so sharply at very short distances from the location of such a seed, that inaccurate placement of these seeds in the axilla or slight deviations in their distribution along the important lymphatic trunks may be responsible for the failure of interstitial irradiation in these locations. Furthermore, such errors are unavoidable and cannot be overcome by acquisition of skill, standardization of procedure or modification of dosage.

The clinical measurements of the size of mammary cancers by caliper and rule, while necessary for the calculation of tissue dosage, are apt to be misleading and dangerous, except for certain encapsulated tumors such as the intracystic adenocarcinomas, papillary intraductal carcinomas and bulky adenocarcinomas in their early stages. In the majority of breast cancers, infiltration of cancer cells extends far beyond the palpable limits of the tumor. In such instances the palpable tumor may be completely devitalized by accurate interstitial irradiation, yet recurrence of the cancer appears later in a part of the breast peripheral to the original tumor. It is therefore of the utmost importance to deliver a lethal dose of radiation to *all* parts of the breast which might contain infiltrating but non-palpable cancer.

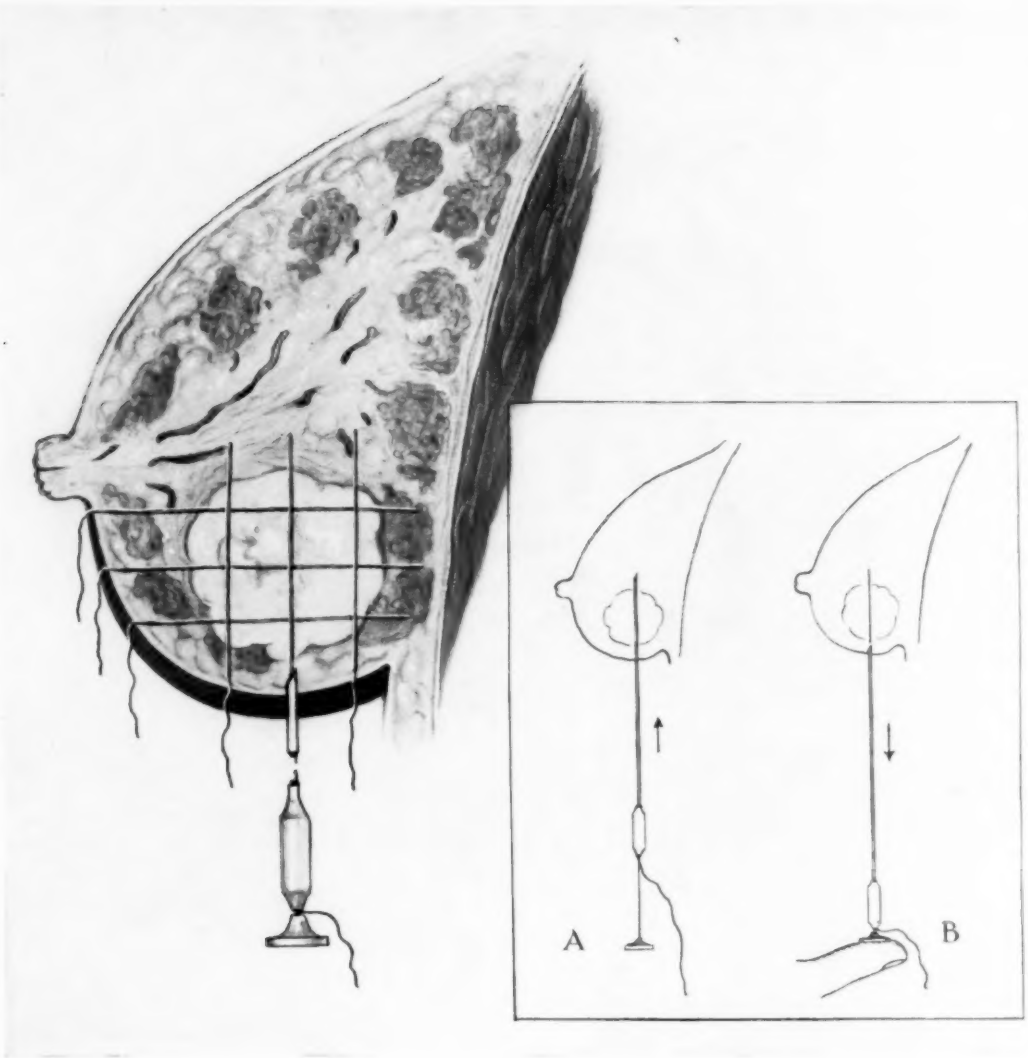

Fig. 2. Sagittal view of breast to show distribution of gold radon transfixion tubes through mammary carcinoma. Insert demonstrates the method of introducing the tube through a hollow trocar needle.

The entire glandular system of the breast is condemned in certain varieties of mammary cancer. Diffuse ductal carcinoma involves the ducts in almost every lobule of the breast. Every duct is a potential site of cancer origin in the case of Paget's disease of the nipple. Even localized carcinomas are accompanied by precancerous changes in the ducts of other lobules. We occasionally see multiple discrete cancers in the same breast; their multicentric origin can be attributed to a common underlying predisposition to cancer, existent throughout the entire breast.

The factors, enumerated above, and which militate against successful treatment by gold radon seeds, suggested one important and imperative requirement. *The breast containing the cancer and the adjacent regions of lymphatic drainage must receive diffuse rather than focal interstitial irradiation.* It occurred to us that the substitution of linear for point sources of radiation would afford a more accurate placement and a more diffuse distribution of interstitial irradiation. Accordingly, we collected radon in long capillary gold tubes of 0.3 mm. filter, the length being determined

in each instance by the size of the breast. These hollow gold wires are sealed at their extremities. Waxed silk threads are attached on caps to these capillary tubes to permit their withdrawal after the proper time has elapsed.

The flexibility and small caliber of these gold capillary tubes facilitate their introduction in the same manner as the implantation of gold radon seeds. They are placed within the trocar needles with the attached threads projecting from the hilts. The tumor, breast, axilla or tissue to be irradiated

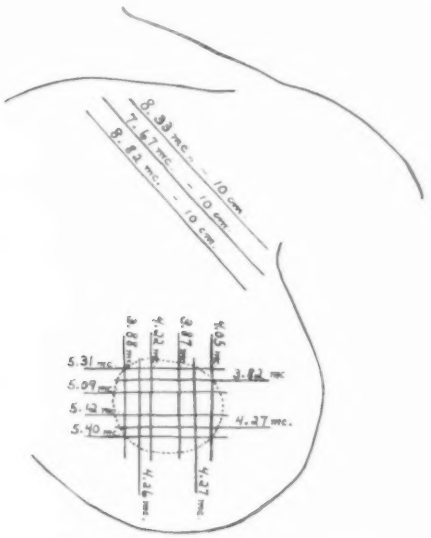

Fig. 3. F. M., a widowed Irish housewife, aged seventy-two, applied to the Memorial Hospital on Nov. 5, 1930, with the complaint of a lump in her left breast. On examination, a tumor measuring 4.25 × 4.25 × 3.5 cm. was felt in the lower segment of the left breast. There were no palpable axillary or supraclavicular lymph nodes. The diagnosis was primary operable carcinoma of the left breast. A preliminary high voltage roentgen cycle of four treatments was given to the left breast and drainage areas (Nov. 19, 1930). This treatment was followed (Nov. 21, 1930) by the implantation of gold radon transfixion tubes, which were distributed as shown above. The twelve tubes in the breast tumor were 5 and 5.5 cm. in length; the axillary tubes were 10 cm. long. The tubes in the breast tumor which contained 53.6 mc. of radon were left in situ for 141 hours to deliver a dose of 35 millicuries-destroyed. The dose in the axilla was 24.8 millicuries-destroyed in three weeks' time. A moderate radium reaction occurred in the breast; healing was prolonged. On June 8, 1931, there was no evidence of carcinoma.

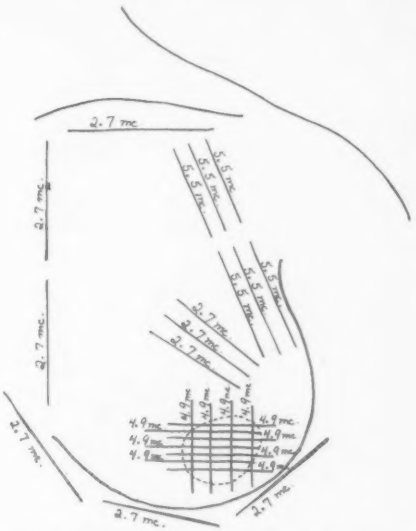

Fig. 4. M. B., a multiparous Russian woman, aged forty, applied to the Memorial Hospital in November, 1930, complaining of a lump in her left breast. On examination a tumor measuring 6.75 × 6 × 5 cm. was felt in the lower outer quadrant of the left breast. There were several large firm nodes in the left axilla. The diagnosis was primary operable carcinoma of the left breast with metastases to left axilla. A preliminary high voltage roentgen cycle of four treatments was given to the left breast and drainage areas (Nov. 25, 1930). This treatment was followed (Jan. 28, 1931) by the implantation of gold radon transfixion tubes, which were distributed as shown above. All the tubes were 5.5 cm. in length. These radon tubes were left in the breast, axilla and paramammary region for three weeks, during which time the greater part of the radon content had decayed. The dose in the axilla was 33 millicuries-destroyed. The breast proper received 53 millicuries-destroyed and the paramammary region, 23 millicuries-destroyed. A left radical mastectomy was performed with difficulty seven weeks later. The tumor had been completely destroyed in breast and axilla. There was diffuse homogeneous fibrosis and foci of fat necrosis throughout the breast. There is no evidence of carcinoma at this time (July 16, 1931).

is transfixed by the needle; as the needle is withdrawn the gold capillary tube is left in place, having been extruded from the needle point by gentle pressure against the wire obturator in the trocar.

The radon transfixion tubes are introduced in gridiron fashion so as to transfix the tumor and surrounding tissue in three planes, namely, horizontally, vertically and anteroposteriorly. The tubes are of suffi-

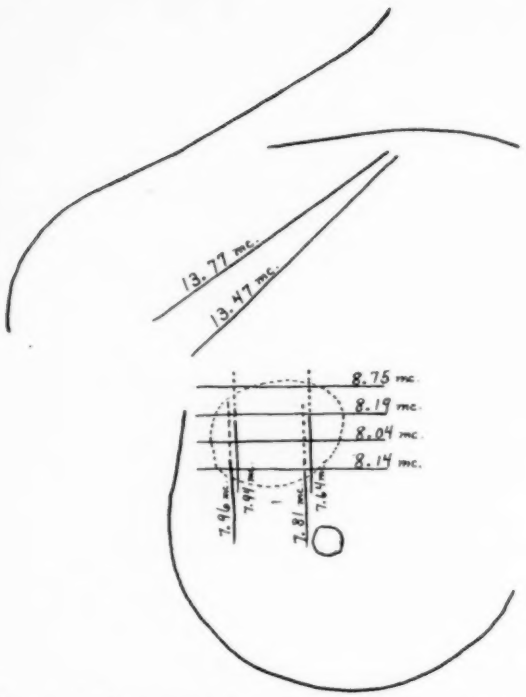

Fig. 5. A. S., a married woman, aged forty-six, applied to the Memorial Hospital on July 30, 1930, complaining of mastalgia and a lump in the right breast. On examination, a tumor measuring 4.5 ×4.5 cm. was felt in the upper outer quadrant of the right breast. The tumor was adherent to the skin and elevated the breast. There was one hard palpable lymph node in the right axilla. A roentgenogram of the chest was negative for metastasis to the lungs. The clinical diagnosis was primary operable carcinoma of the right breast.

External irradiation was immediately instituted (Aug. 3, 1930–Aug. 8, 1930) giving doses of 16,000 milligram-hours with a filter of 0.35 mm. platinum and 1.5 mm. brass and a distance of 6 cm. by means of the 4 gram radium element pack, directed over the breast, axilla and supraclavicular space. On August 15, 1930, interstitial irradiation was given by inserting irremovable gold radon transfixion tubes into the affected breast and axilla. The two axillary tubes were 10 cm. in length; the tubes within the breast were 5 and 6 cm. long. These radon tubes were permanently implanted, because we had not yet devised the cap and thread attachment. The dose delivered to the breast was 64.5 millicuries-destroyed; the axilla received 27.3 millicuries-destroyed.

The radium reaction was marked with considerable denudation of skin. Three months later a right radical mastectomy was done. Examination of the amputated breast showed an indefinite mass 4 ×3 ×2 cm. that was moderately firm yet lacking all the hardness of carcinoma. The axillary nodes were replaced by fat. Under the microscope, a few degenerating hyperchromatic cells were seen in regions of fibrosis but no viable carcinoma was recognized. There was marked radium necrosis, sclerosis and arteritis. The wound healed readily. There is now no evidence of carcinoma.

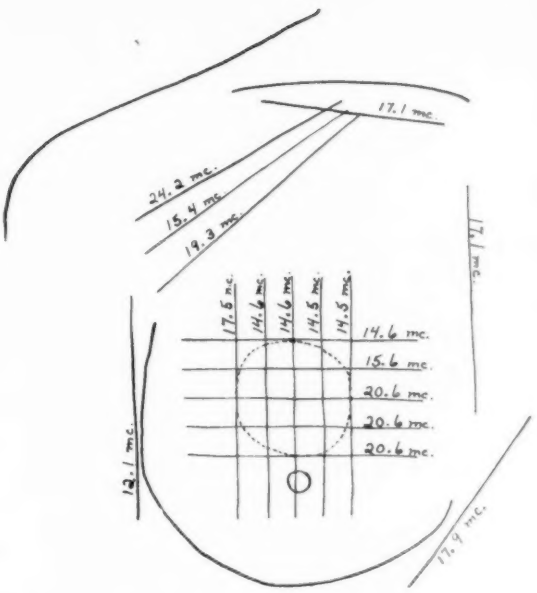

Fig. 6. A. K., a married woman, aged thirty-nine, applied to the Memorial Hospital on March 3, 1931, complaining of a lump in the right breast. On examination, a tumor measuring 5.5 ×4.5 ×3 cm. was felt in the right breast. The skin was adherent, the nipple was retracted and the breast was elevated. There were numerous large, hard, fixed, lymph nodes extending from the border of the pectoralis major muscle to the apex of the axilla. A roentgenogram of the chest was negative for metastasis to the lungs. Because of the patient's age and the extent of the disease, the treatment was by irradiation only. An aspiration biopsy of the tumor revealed carcinoma.

A preliminary high voltage roentgen cycle was given to the right breast, right axilla and right supraclavicular space. On March 27, 1931, gold radon transfixion tubes were implanted in the breast and axilla; the distribution may be seen in the accompanying illustration. The axillary tubes were 10 cm. in length; the tubes within the breast were 6.5 cm. long. The 168 mc. in the breast were withdrawn in 60 hours to deliver a dose of 60 millicuries-destroyed to the tumor and its environment. The 60 millicuries in the axilla were withdrawn in 92 hours to deliver a dose of 30 millicuries-destroyed to the right axilla. Six millicuries-destroyed were given to each of the paramammary regions, namely, epigastric, parasternal, subclavicular and pectoral. The radium reaction was severe and much of the skin of the breast was denuded. The tumor disappeared entirely in the breast and axilla.

cient length to extend completely through and beyond the palpable margins of the tumor in order to irradiate its environment. The ends of the wires are well beneath the skin which is perforated only by the attached silk threads. Twelve to sixteen radon tubes suffice to irradiate the average breast and the tumor which it contains. The four or six tubes inserted anteroposteriorly are short to correspond with the thickness of the breast at the site of the tumor. The transverse tubes, also four to six in number, are slightly shorter than the width of the breast. The tubes for vertical implantation are longer in pendulous breasts. In an average case the length of the gold radon tubes might be as follows: anteroposteriorly, 4 cm.; transversely, 6 cm.; vertically, 8 cm.

In the axilla, they are inserted fanwise in order to afford diffuse and accurate irradiation to the axillary contents. The scheme for distribution of these radon tubes in the axilla calls for three tubes, each 10 cm. in length or six tubes, 6 cm. in length. They are introduced from below upward or downward from the subclavicular region, care being taken to avoid the axillary vessels and brachial plexus at the apex of the axilla. Large axillary nodes, easily held within the grasp of the fingers, should also receive focal—and therefore more intense—irradiation by means of supplementary gold radon seeds. The gold tubes are inserted while the arm is held in abduction.

Additional gold radon tubes, 6 or 7 cm. in length, are placed deeply on the fascia, in the paramammary regions, where the principle of a circumferential barrage is employed. One tube is placed parallel to and below the clavicle; another extends diagonally across the junction of breast and epigastrium; a third tube lies along the lowermost border of the pectoral fold; finally an important tube is inserted parasternally. In lieu of the latter tube, small radon tubes, 2 cm. in length, may be introduced into each intercostal space, near the sternal margin, in an attempt to block the lymphatic vessels which enter the mediastinum in this location. The attached threads for the withdrawal of the tubes are tied snugly across the breast and thereby main-

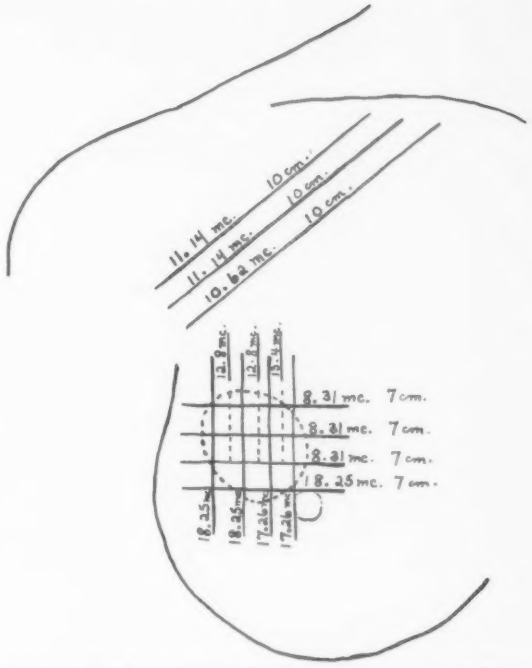

Fig. 7. R. C., a single Italian woman, aged thirty-four, applied to the Memorial Hospital in November, 1930, complaining of a lump in her right breast. On examination a tumor measuring 5.5 cm. in all diameters was felt in the upper outer quadrant of the right breast. There was one firm lymph node palpable in the right axilla. A biopsy with the Hoffman punch showed carcinoma. The diagnosis was primary operable carcinoma of the right breast with axillary metastasis. High voltage roentgen treatments were given to the axilla, supraclavicular space, lateral and medial aspects of the breast. This treatment was followed immediately (Dec. 19, 1930) by the implantation of gold radon transfixion tubes which were distributed as shown above. The tubes in the axilla were 10 cm. in length; the vertically and transversely placed tubes in the breast were 7 cm. long; the tubes in the anteroposterior plane were 5 cm. long.

Dose. The dose of radiation to the axilla was 32.9 millicuries-destroyed, which was given in three weeks. The breast was treated with 153.2 mc. of radon in 11 gold tubes. These tubes were withdrawn in 75 hours to deliver a dose of 66 millicuries-destroyed to the breast. The reaction in the skin and deeper tissues was severe but healed without complications. In April, 1931, a node in the right axilla received 13.3 mc. in 5 gold seeds. There is no evidence now of cancer in the breast.

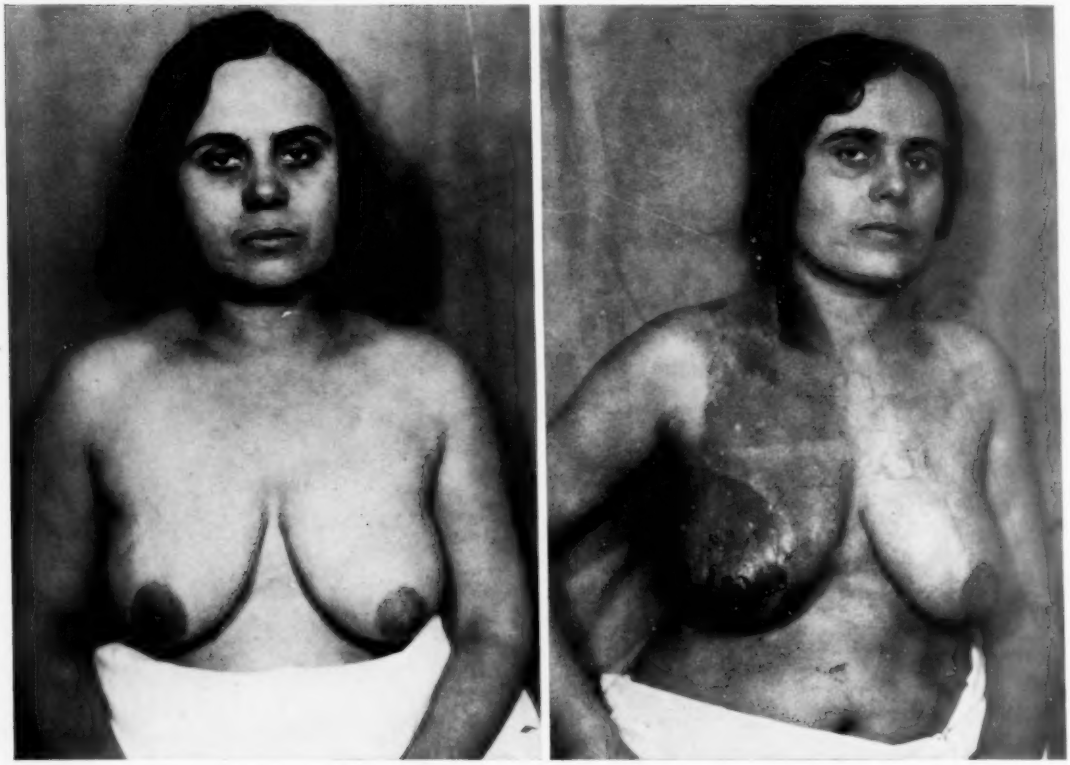

Fig. 8. Same patient as in Figure 7. Before and shortly after irradiation. To show the degree and extent of the radium reaction.

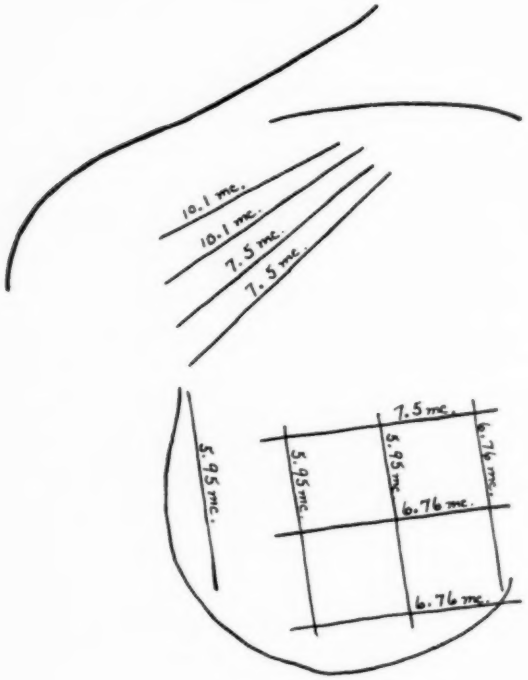

Fig. 9. H. M., a married woman, aged thirty-five, applied to the Memorial Hospital in February, 1931, for treatment after a local excision in January, 1931, of a breast tumor at another hospital. On examination, the right breast adjacent to the scar was diffusely thickened. There was one soft enlarged lymph node in the right axilla. Microscopical examination of the submitted breast tissue revealed a small cell, diffusely infiltrating duct carcinoma, slightly radiosensitive. High voltage roentgen treatments were given to the axilla, supraclavicular space, lateral and medial aspects of the breast. This treatment was followed immediately (April 1, 1931) by the implantation of gold radon transfixion tubes which were distributed as shown. The tubes in the axilla were 10 cm. in length; the other tubes were 7 cm. long.

Dose. These tubes were inserted without attached threads, so the entire content of radon was consumed. The breast received a dose of 45.6 millicuries-destroyed; 35.2 millicuries-destroyed were delivered into the axilla. On May 29, 1931, after an interval of two months, a right radical mastectomy was done. The wound healed quickly. Microscopical examination of the amputated breast showed fibrosis, edema, fatty detritus, and foreign body reaction but no evidence of carcinoma.

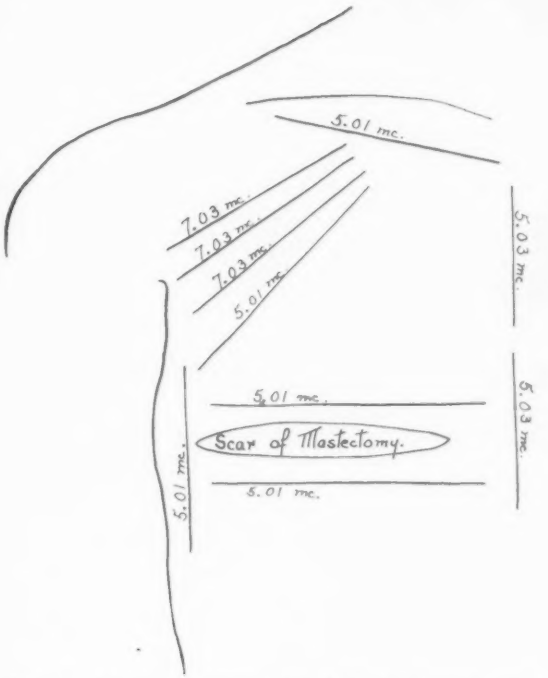

Fig. 10. M. L., an unmarried diabetic woman, aged sixty-eight, applied to the Memorial Hospital on March 11, 1931. On January 21, 1931, a right local mastectomy had been performed at another institution; the amputated breast contained carcinoma. There was no evidence of local recurrence in the wound but the right axilla contained bulky, firm, lymph nodes measuring 5 × 5 cm. A roentgenogram of the chest was negative for metastasis. No roentgen treatments were given.

On March 25, 1931, gold radon transfixion tubes were implanted near the operative site, as well as in the corresponding axilla and paramammary regions. The radon tubes bordering the scar and occupying the lower pectoral, subclavicular and parasternal regions were 7 cm. long and the axillary tubes were 10 cm. in length. Supplementary interstitial irradiation was given to the axillary nodes by the implantation of 15.4 mc. of radon in 8 gold seeds. The radon transfixion tubes were removed in three weeks, having delivered doses of 26 millicuries-destroyed to the axilla and 29 millicuries-destroyed to the paramammary regions.

There was no evidence of carcinoma at the patient's last visit (June 22, 1931).

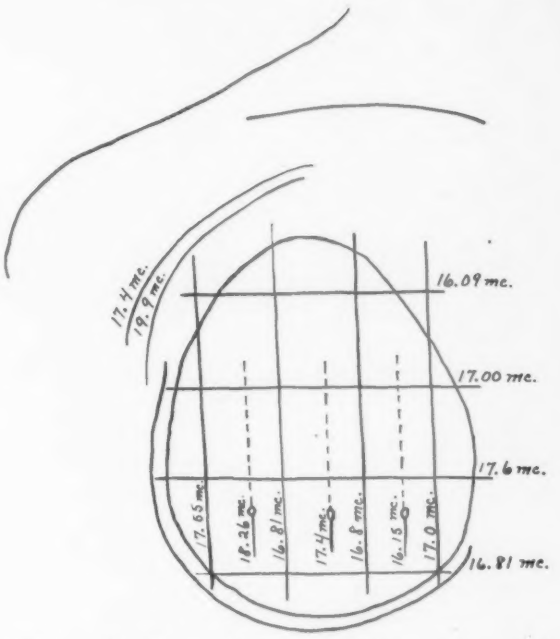

Fig. 11. L. R., a nulliparous married woman, aged thirty-three, applied to the Memorial Hospital on October 22, 1930, complaining of a lump in her right breast. The known duration of this lump was said to be only three weeks. It measured 14 × 10 × 8 cm. The superjacent skin was red and adherent. Large, hard nodes, measuring 4 × 3 × 3 cm. were felt in the right axilla. Although a roentgenogram of the chest was negative for evidence of pulmonary metastasis the clinical diagnosis was primary inoperable carcinoma of the breast. The criteria of inoperability were (*a*) the acute inflammatory character of the cancer, (*b*) the great bulk of the primary breast and secondary axillary tumors and (*c*) the young age of the patient. An aspiration biopsy of the breast revealed epithelial clusters suggestive of carcinoma.

No preliminary external irradiation was given. On October 19, 1930, gold radon transfixion tubes were distributed through the breast and axilla as shown above. The tubes were withdrawn on November 3, 1930 (82 hours of irradiation) to deliver a dose of 86.8 millicuries-destroyed to the breast. The dose in the right axilla was 37.3 millicuries-destroyed. A moderate radium reaction ensued, but the skin healed readily. By January, 1931, the mammary and axillary tumors had entirely disappeared; the breast was fibrotic but elastic. The patient died however on March 13, 1931, of metastasis in the liver.

tain the position of the implants. The careful pursuance of this technique will avoid irradiation of the brachial plexus and consequent neuritis.

Dosage. The average gold seed is 0.4 cm. long and contains 2 to 3 millicuries of radon. The average gold capillary tube has an initial content of 1.5 to 2 mc. of radon to each centimeter of length, hence the intensity of irradiation is less per unit length

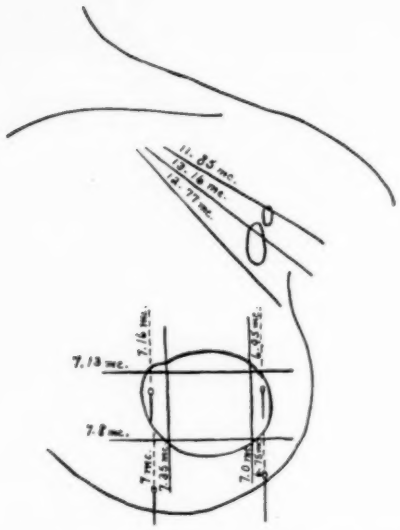

Fig. 12. B. S., a married woman, aged fifty, applied to the Memorial Hospital on August 13, 1930, complaining of a lump in her left breast. The tumor measured 5.5 × 5.5 × 4.5 cm., occupied the central segment of the breast, caused retraction of the nipple and was adherent to the skin. The left axillary and supraclavicular lymph nodes were large and firm. A roentgenogram of the chest revealed evidence of metastasis in the right lung. The clinical diagnosis was primary inoperable carcinoma of the left breast.

A high voltage roentgen cycle of four exposures was given to the left breast and drainage regions (Aug. 18, 1930 to Aug. 25, 1930). On August 29, 1930, gold radon transfixion tubes were implanted in the breast and axilla; the distribution of these tubes is shown above. The axillary tubes were 10 cm. in length; the tubes in the breast were 6 cm. long. They were permanently implanted, as no threads were attached. The breast received a dose of 57 millicuries-destroyed and the dose in the axilla was 37.8 millicuries-destroyed.

A severe radium reaction followed this treatment. Infection occurred along one of the resident tubes and healing was delayed. A local palliative mastectomy was done on December 31, 1930. The breast showed microscopic evidence of radiation necrosis, calcific deposits, marked tumor destruction and infection. Rare areas of persistent tumor, some of which appeared viable, indicated the failure of these treatments to effect complete destruction of the cancer.

Later, several high voltage roentgen treatments were given to the right chest anteriorly and posteriorly in a futile attempt to check the growth of the metastatic carcinoma in the lungs. The patient died in July, 1931.

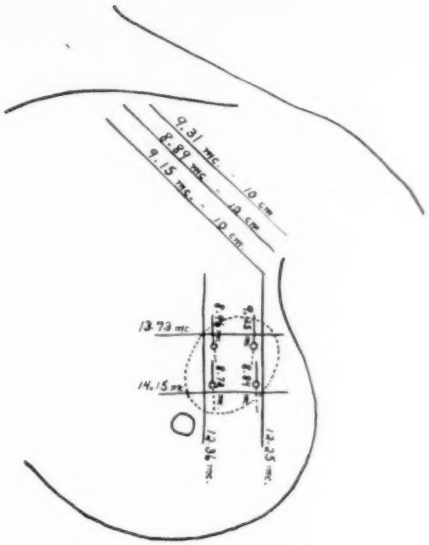

Fig. 13. K. L., a widow, aged fifty-four, applied to the Memorial Hospital on August 11, 1930, complaining of a lump in her left breast. On examination a tumor, measuring 6×5 cm. was felt in the axillary tail of the left breast. It caused retraction of the nipple and dimpling of the skin. Several large, hard, lymph nodes were palpated in the left axilla. A roentgenogram of the chest revealed a mass in the right upper mediastinum and a metastasis of the sarcomatous type in the left lung. An aspiration biopsy was positive for carcinoma. The diagnosis was primary inoperable carcinoma of the breast.

A preliminary high voltage roentgen cycle was given to the left breast and drainage regions (Aug. 18, 1930 to Sept. 2, 1930). On September 3, 1930, gold radon transfixion tubes were inserted in the left breast and left axilla; the distribution is shown in the accompanying diagram. The tubes in the axilla were 10 cm. in length; those in the breast 6 cm. long. They were permanently implanted as no threads were attached. The doses were as follows: breast—88.3 millicuries-destroyed, axilla—27.4 millicuries-destroyed.

The radium reaction was severe but the breast and axilla healed with resolution of the palpable tumors. The pulmonary symptoms of cough and dyspnea have increased in severity, but the patient has been able to resume her work (June, 1931).

than in the gold seeds. By this method 100 to 200 mc. of radon are inserted within the breast and its adjacent environment; this value for radon used does not constitute the dose delivered inasmuch as the tubes are withdrawn after sufficient radon has

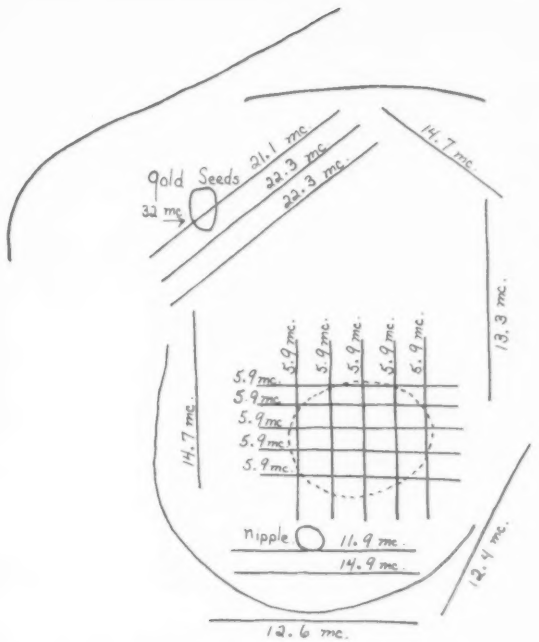

FIG. 14. H. G., a single Jewess, aged twenty-seven, applied to the Memorial Hospital in February, 1931, complaining of a lump in her right breast. On examination, a tumor measuring 5.5×5×4 cm. was felt in the upper segment of the right breast. There were several large firm nodes in the right axilla and one small suspicious node in the left supraclavicular space. The diagnosis was primary inoperable carcinoma of the right breast with metastases to right axilla and left supraclavicular space. Aspiration biopsy revealed carcinoma. High voltage roentgen treatments were given to the axilla, supraclavicular space, lateral and medial aspects of the breast. This treatment was followed immediately (Mar. 19, 1931) by the implantation of gold radon transfixion tubes which were distributed as shown above. The tubes in the axilla were 10 cm. in length; all other tubes were 7 cm. long.

Dose. Sixty-six millicuries were introduced into the axilla; the axillary tubes were withdrawn after 48 hours, having delivered a dose of 20 millicuries-destroyed. Thirty-two millicuries in gold seeds were inserted directly into the palpable axillary nodes for supplementary focal irradiation.

The breast and paramammary region were treated with 149 mc. of radon in 17 gold tubes. These tubes were withdrawn in four to eight days to deliver 35 millicuries-destroyed to the paramammary region and 60 millicuries-destroyed to the breast proper. One gold seed containing 2 mc. of radon was permanently implanted in the small left supraclavicular node.

The reaction in the skin and deeper tissues was intense, but had subsided completely six weeks later. The tumor in the breast and the palpable metastases have entirely regressed (July 16, 1931).

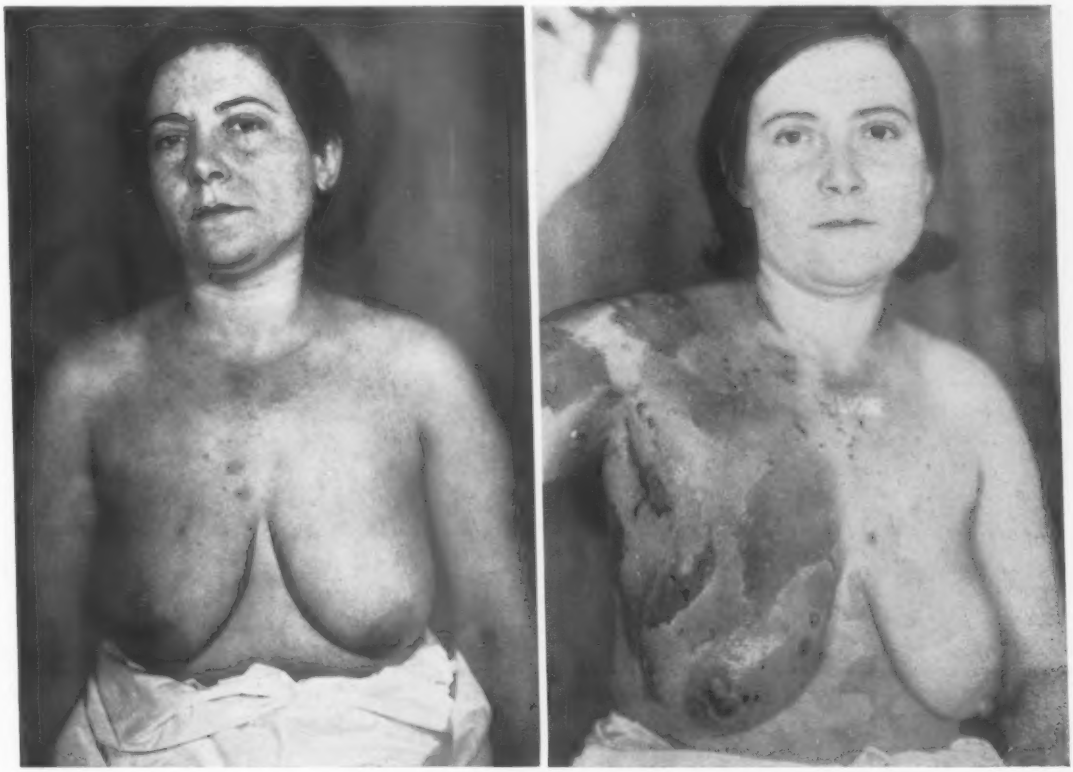

FIG. 15. Same patient as in Figure 14. Before and shortly after irradiation. To show the degree and extent of the radium reaction.

decayed to give the proper dose, in contradistinction to the gold radon seeds which are left permanently in the breast. We have previously shown the calculated doses in gold radon seeds for tumors of different dimensions. These data are only correct for point sources of irradiation such as afforded by the gold radon seeds. Nevertheless we were able to arrive quickly at a satisfactory dosage by giving slightly less than the number of millicuries-destroyed in gold radon tubes that would have been required if the gold radon seeds were used in a similar case. We employed the same dosage as would be used for gold radon seeds in several patients and found that the reaction of skin and mammary tissues was too great to be tolerated by the average patient. Thirty to 35 millicuries-destroyed can be given safely in the axilla by this

Table I

Operable carcinomas of breast treated by external irradiation and gold-filtered radon capillary tubes

Case No.	Age	Location of Tumor Size	Rate of Growth	Axilla	External Irradiation	Interstitial Irradiation by Gold Radon Capillary Tubes				
						Number of Tubes	Length of Tubes	Initial Strength of Radon	Time	Dose Delivered
F.M. 1	72	Left 4.25 x 4.25 x 3.5 cm.	Moderate		11–19–30 Four high voltage x-ray treatments to breast and drainage regions	12	5 cm. 5.5 cm.	53.6 mc.	141 hours	11–21–31 35 mc.
M.B. 2	40	Left 6.75 x 6 x 5 cm.	Rapid	Adenopathy	11–25–30 Four high voltage x-ray treatments to breast and drainage regions	17	5.5 cm.	78.2 mc.	3 weeks	1–28–31 76 mc.
A.S. 3	46	Right 4.25 x 4.25 cm.	Moderate	Adenopathy	8–3–30 Four-gram radium pack at 6 cm. distance Breast—16,000 mg-hr. Axilla—16,000 mg-hr. Supraclavicular space—16,000 mg-hr.	8	6 cm.	64.5 mc.	Permanent	8–15–30 64.5 mc.
A.K. 4	39	Right 5.5 x 4.5 x 3 cm.	Slow	Adenopathy		14	6.5 cm. 7 cm.	232.2 mc.	60 hours	3–27–31 84 mc.
M.P. 5	46	Right 6 x 5 x 5 cm.	Rapid	Adenopathy	12–15–30 Four high voltage x-ray treatments to breast and drainage regions	14	5.5 cm.	137.0 mc.	77 hours	1–23–31 60 mc.
R.C. 6	34	Right 5.5 x 5.5 x 5.5 cm.	Moderate	Adenopathy	11–26–30 Four high voltage x-ray treatments to breast and drainage regions	11	7 cm. 5 cm.	153.2 mc.	75 hours	12–19–30 66 mc.
H.M. 7	35	Right	Moderate	Adenopathy	3–7–31 Four high voltage x-ray treatments to breast and drainage regions	7	7 cm.	45.6 mc.	2 months	4–1–31 45.6 mc.
M.L. 8	68	Right	Moderate	Adenopathy		6	7 cm.	30.1 mc.	3 weeks	3–25–31 29 mc.

method. Five to 8 millicuries-destroyed is the dosage usually administered to each of the other paramammary regions.

Time Factor. In the case of gold radon seeds, the irradiation is continuous until the radon is completely consumed. The gold radon tubes permit the modification of the intensity of irradiation or time factor by modifying the initial strength of the content of radon and the time of irradiation, which is not possible in the case of irremovable gold radon seeds. For example, the same dose in millicuries-destroyed may be given by tubes containing a large quantity of radon for a short time or by other tubes containing a small quantity of radon for a longer time. If one knows the initial value of the radon employed, the dosage planned, the rate of decay of radon and the time of implantation of the gold

Table I (Continued)

OPERABLE CARCINOMAS OF BREAST TREATED BY EXTERNAL IRRADIATION AND GOLD-FILTERED RADON CAPILLARY TUBES

Axillary Irradiation	Surgery	Interval between Irradiation and Operation	Wound Healing	End-Results	Pathology	Remarks
11–21–30 3 tubes—10 cm. Dose—24.8 mc.			Slow healing of radium reaction	4–27–31 No evidence of disease		
1–30–31 6 tubes—5.5 cm. Dose—33.0 mc.	3–20–31 Left radical mastectomy	7 weeks	Secondary healing, slow and delayed	5–18–31 No evidence of disease	Fibrosis diffuse throughout breast. No residual tumor. Necrosis of fat	
8–15–30 2 tubes—10 cm. Dose—27.24 mc.	11–14–30 Right radical mastectomy	3 months	Excellent primary union	5–25–31 No evidence of disease	Radium necrosis, sclerosis and arteritis. No viable carcinoma. Few degenerating hyperchromatic cell groups in regions of fibrosis	
3–27–31 3 tubes—10 cm. 60 mc. for 100 hr. Dose—30 mc.					3–27–31 Aspiration biopsy. Carcinoma of breast	
1–23–31 3 tubes—10 cm. Dose—40.7 mc.	4–1–31 Right radical mastectomy	9 weeks	Infection. Slow secondary healing	5–7–31 No evidence of disease	Diffuse infiltrating duct carcinoma. Radiosensitive. Metastatic to axillary nodes. Grade III	Positive Wassermann reaction
12–19–30 3 tubes—10 cm. 32.9 mc. 4–22–31 13.3 mc. in 5 gold seeds			Intense radium reaction. Slow healing	5–11–31 Complete regression of breast tumor. Axillary node recurrent	12–20–30 Aspiration biopsy. Carcinoma of breast	
4–1–31 4 tubes—10 cm. Dose—35.2 mc.	5–29–31 Right radical mastectomy	2 months	Good wound healing	6–15–31 No evidence of disease	5–29–31 Fibrosis. No residual tumor. Foreign body reaction. Previous biopsy showed small cell diffuse duct carcinoma. Grade III	
3–25–31 15.4 mc. in 8 gold seeds. Also 4 tubes 10 cm. Dose—26.1 mc.				5–11–31 No evidence of disease. Axillary nodes not palpable		Jan., 1931. Local mastectomy at another hospital

transfixion tubes, it is an easy matter to calculate the time required for the treatment.

The breast, axilla and paramammary region become quite red and edematous following this method of irradiation. The tissue reaction is diffuse and widespread and is intended to include the entire cancer-bearing area. After the reaction has subsided and the tumor and palpable lymph nodes have disappeared, the breast is flexible and elastic but of generally firmer texture. The axilla is not scarred sufficiently to impair the movements of the arm and shoulder. This post-irradiation fibrosis is desirable; if the carcinoma has escaped complete destruction, the residual carcinoma cells may be enveloped by dense scar tissue (abortive fibrosis) where they may remain inactive for years. This status is sought for many advanced inoperable mammary cancers, but for operable carcinomas complete tumor destruction is the only satisfactory end-point for this method of irradiation.

Table II

PRIMARY INOPERABLE CARCINOMAS OF BREAST TREATED BY EXTERNAL IRRADIATION AND GOLD-FILTERED RADON CAPILLARY TUBES

Case No.	Age	Location of Tumor Size	Cause of Inoperability	Rate of Growth	Axilla	X-Ray Treatments	Interstitial Irradiation by Gold Radon Capillary Tubes				
							Number of Tubes	Length of Tubes	Initial Strength of Radon	Time	Dose Delivered
E.D. 1	73	Left 7 x 6 x 5 cm.	Supraclavicular nodes	Slow	Adenopathy	7–8–30 Four high voltage exposures to breast and drainage regions	3	13 cm.	55.1 mc.	14 days	9–24–30 50 mc.
R.D. 2	52	Right 6.5 x 6.5 x 5.5 cm.	Metastases to bone	Rapid	Adenopathy	9–24–30 Four high voltage exposures to breast and drainage regions	7	7 cm.	79.3 mc.	Permanent	10–10–30 79.3 mc.
L.R. 3	33	Right 14 x 10 x 8 cm.	Bulk of axillary metastases	Rapid	Adenopathy	None	11	7 cm.	186.9 mc.	82 hours	10–31–30 86.8 mc.
B.S. 4	50	Left 5.5 x 5.5 x 4.5 cm.	Metastases to lungs and supraclavicular nodes	Moderate	Adenopathy	8–18–30 Four high voltage exposures to breast and drainage regions	8	6 cm.	57.14 mc.	Permanent	8–29–30 57.14 mc.
K.L. 5	54	Left 6 x 5 cm.	Pulmonary metastasis	Moderate	Adenopathy	8–18–30 Four high voltage exposures to breast and drainage regions	8	6 cm.	88.26 mc.	Permanent	9–3–30 88.26 mc.
H.G. 6	27	Right 5.5 x 5 x 4 cm.	Supraclavicular nodes	Rapid	Adenopathy	2–23–31 Four high voltage exposures to breast and drainage regions	17	7 cm.	148.9 mc.	4 to 8 days	3–19–31 94 mc.
B.S. 7	30	Left 12 x 10 cm.	Bulk of axillary metastases	Rapid	Adenopathy 6 x 5 cm.	None	12	12 cm. 10 cm. 3 cm.	180.13 mc.	2½ to 4½ days	4–9–31 88 mc.

Interstitial irradiation by gold radon transfixion tubes is absolutely contraindicated if subsequent surgery is contemplated. It is a substitute for surgery rather than a preoperative measure. Attempts at radical mastectomy after this method of irradiation have been universal failures because (*a*) the scarring within the axilla prevents proper exposure of the vessels and complete dissection, and (*b*) wound healing after such operations is always secondary and prolonged.

This method of irradiation has been used in the treatment of 15 patients with mammary cancer since August, 1930. Of these, 7 had inoperable, and 8 had operable carcinomas of the breast. The results have been very gratifying, considering the large size of the tumors selected for this treatment. For example, the 5 largest tumors measured 14×10 cm., 12×10 cm., 7×6 cm., 6.5×6.5 cm., and 6×5 cm.; all disappeared completely following irradiation and have not recurred to date.*

TABLE II (Continued)

PRIMARY INOPERABLE CARCINOMAS OF BREAST TREATED BY EXTERNAL IRRADIATION AND GOLD-FILTERED RADON CAPILLARY TUBES

Tubes / Dose Delivered	Axillary Irradiation	Surgery	Interval between Irradiation and Operation	Wound Healing	End-Results	Pathology	Remarks
9–24–30 50 mc.	9–24–30 5 tubes—6 cm. 37.5 mc. for 14 days				Nov., 1930. Marked regression Jan., 1931. Death No recurrence in breast		
10–10–3 79.3 mc.	10–10–31 3 tubes—10 cm. 43.8 mc. dose			Skin healed after reaction	Regression of tumor but death 5–23–31 No local recurrence in breast		Irremovable tubes
10–31–30 86.8 mc.	10–31–30 2 tubes—10 cm. 37.3 mc.			Skin healed after reaction	Complete disappearance of tumor in breast but death 4–13–31 Metastasis to liver	10–30–30 Biopsy (aspiration). Clusters of epithelial cells suggestive of carcinoma	Irradiation well distributed in breast and excellent local regression
8–29–30 57.14 mc	8–29–30 3 tubes—10 cm. 37.8 mc.	12–31–30 Simple mastectomy for radionecrosis	2 months	Delayed. Slow	July, 1931 No local recurrence but progress of metastases	Ulcer (radionecrotic) of breast. Marked destruction of tumor. Calcific deposits. Rare regions of tumor, some of which appear viable	Irremovable tubes
9–3–30 88.26 mc	9–3–30 3 tubes—10 cm. 27.4 mc.			Severe reaction of skin. Slow but complete healing	5–2–31 Complete regression of tumor in breast. Axillary metastases are recurrent	9–24–30 Aspiration biopsy. Carcinoma of breast	
3–19–31 94 mc.	3–14–31 3 tubes—10 cm. 66 mc. for 2 days. Dose—20 mc. Also 32 mc. in gold seeds			Intense reaction of skin but healing in 7 weeks	Complete clinical regression of tumor. No evidence	2–24–41 Aspiration biopsy. Bulky adenocarcinoma	Also 2 mc. in gold seed in supraclavicular node 3–14–31
4–9–31 88 mc.	4–9–31 6 tubes—3 cm. 94.0 mc. for 2½ days. Dose—35 mc.			Severe skin reaction	7–16–31 Complete disappearance of tumor in breast and axillary lymph nodes	4–9–31 Aspiration biopsy. Carcinoma of breast	

* For discussion see page 556.

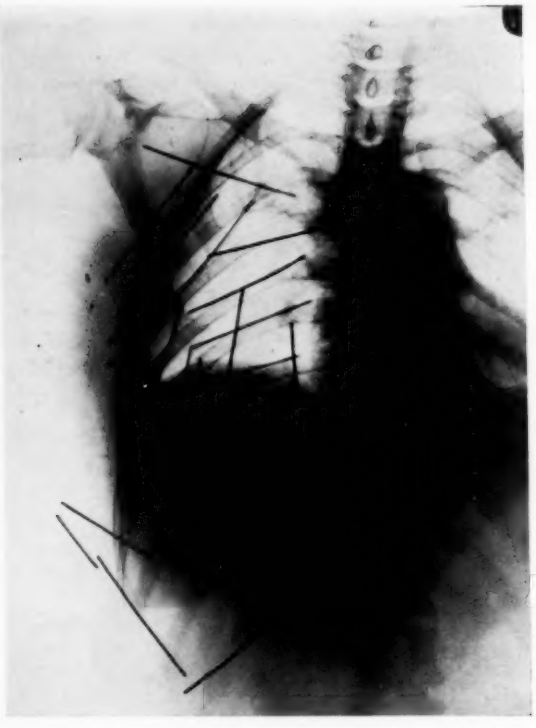

Fig. 16. Same patient as in Figures 14 and 15. Roentgenogram of chest to show the distribution of the gold radon transfixion tubes and gold seeds.

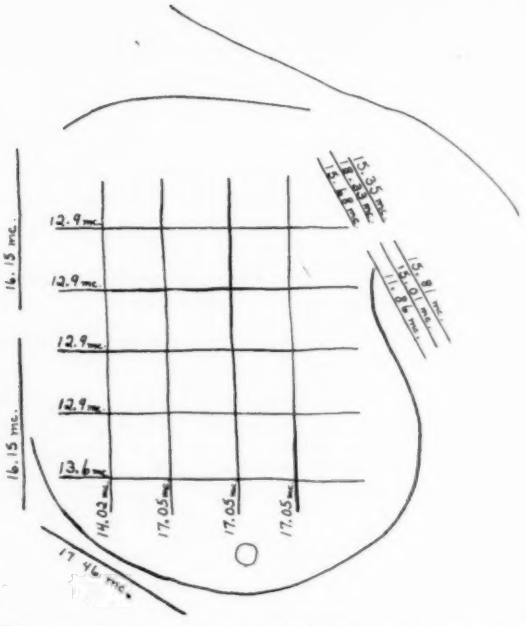

Fig. 17. B. S., an unmarried Roumanian woman, aged thirty-six, applied to the Memorial Hospital on April 3, 1931, complaining of an enormous lump in her left breast. The tumor in the breast measured 12.5 × 10 × 6.5 cm; the fused axillary lymph nodes measured 6 × 5 cm. An aspiration biopsy was positive for carcinoma. A roentgenogram of the chest was negative for evidence of pulmonary metastasis. On account of the size of the tumor and the young age of the patient, the diagnosis was primary inoperable carcinoma of the breast.

No external irradiation was employed. On April 9, 1931, gold radon transfixion tubes were inserted in the breast, axilla, parasternal and epigastric regions; the distribution is shown above. The tubes in the breast were 12 and 10 cm. in length; the axillary tubes were 3 cm. long. The 9 tubes in the breast containing 130.4 mc. were withdrawn after 4 days and 7 hours to deliver a dose of 70 millicuries-destroyed. The 6 axillary tubes containing 94 mc. of radon were withdrawn in 2 days and 14 hours to deliver a dose of 35 millicuries-destroyed. The two parasternal tubes and the one epigastric tube were withdrawn in 2 days and 12 hours, each tube having delivered a dose of 6 millicuries-destroyed.

The radium reaction was of moderate severity. By July 16, 1931, the mammary tumor and axillary lymph nodes had completely disappeared.

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Vol. XXVII, No. 4

INTERSTITIAL IRRADIATION OF MAMMARY CANCER WITH SPECIAL REFERENCE TO MEASURED TISSUE DOSAGE*

A SUPPLEMENTARY REPORT

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THE subject of irradiation by means of measured tissue dosage in the treatment of cancer of the breast was presented by us one year ago.[1] A considerable number of the patients reported at that time were irradiated by external means alone, using either high voltage roentgen rays or the radium element pack, or a combination of these two agents. In the present study, the patients in whom only external irradiation was employed have been excluded, as we desired to consider especially the treatment of mammary cancer by measured doses of interstitial gold radon seeds employed alone or in combination with some form of external irradiation.

Several patients previously reported, in whom histological verification of the disease was lacking, have been eliminated, as well as three patients who left the clinic and did not return. The total number under consideration is forty-one, 30 of which were primary operable and 11 primary inoperable cases. The shortest time that an individual has been under observation since treatment is one year and one month, the longest interval being two years and one month. The vast majority of the patients have been followed continuously for more than one and one-half years. The results obtained up to the present time are here placed on record and some conclusions drawn concerning the efficacy of the method.

The work with measured tissue dosage in the treatment of mammary cancer was undertaken at the Memorial Hospital because it seemed to offer an accurate method of treating the disease. Moreover, if a sufficient number of operable cases were so treated, followed by radical amputation, it was felt that we would be able to determine, with a considerable degree of accuracy, the minimum dose of radiation necessary to devitalize completely mammary cancer. Palliative mastectomy in certain of the primary inoperable cases would also furnish additional data. It seemed desirable, also, to determine whether or not this technique could be made use of to the advantage of the patient as a routine preoperative measure. The study which has been carried out might also demonstrate the limitations of the method as well as contraindications to its use, if there were any.

Eight of the primary operable patients and 4 in the primary inoperable group were treated by interstitial irradiation alone. The remaining 29 cases received a combination of external and interstitial irradiation.

Upon theoretical grounds it would appear that interstitial irradiation had best be preceded by adequate external irradiation. Such a preliminary procedure often causes a considerable regression in the size of the growth, with tissue changes in the tumor and its environment, which lessens the liability of a possible dissemination of the disease.

A careful analysis of the 22 patients in whom external irradiation was employed as a preliminary measure shows no distinguishable difference in the degree of de-

[1] Lee, Burton J., Pack, George T., Quimby, Edith H., and Stewart, Fred W. Irradiation of mammary cancer, with special reference to measured tissue dosage. Read before the Radiological Section of the American Medical Association in Detroit, June 25, 1930. *Arch. Surg.*, March, 1932, *24*, 339–410.

* Read in the Symposium on Carcinoma of the Breast, at the Sixteenth Annual Meeting, American Radium Society, Philadelphia, Pa., June 8–9, 1931.

struction of the tumor or the result obtained to date whether roentgen rays were employed alone, or combined with the radium element pack.

In the former paper, the physical principles underlying the estimation of tissue dosage were fully discussed, as was also the technique of interstitial irradiation. The entire irradiation was delivered within three weeks. The application of high voltage roentgen treatment to the breast and drainage areas consumed, approximately, eight days, and when the radium element pack was employed, ten days were necessary to complete the treatment. Interstitial radon was implanted about ten days after the completion of the external therapy, and the irradiation from the implanted seeds was effective for the ensuing two weeks.

The gold seeds were sterilized in alcohol and introduced under general anesthesia, with strict aseptic technique. The radon seeds were implanted into the tumor through sterile needle trocars carrying a small metal plunger. An effort was made to place the seeds within the inner half of the imagined sphere to be treated, because the estimation of dosage made in the physical laboratory is based upon such an accurate introduction. Accuracy of implantation of the seeds is essential, for if this is faulty, the estimation of dosage is vitiated and complete tumor devitalization is not accomplished. Examination of the gross specimen removed by radical amputation demonstrated, in a few instances, gold seeds lying in muscles of the chest wall well beneath the original site of the tumor-bearing area. This low percentage of faulty implantation is gratifying, considering the newness of the method and our previous inexperience with it.

The implantation was often attended with some oozing, which raised the question of the possibility of introducing tumor cells into lymph or venous channels. Our survey of the group has revealed no case of rapid metastasis which could be interpreted as caused by an implant of tumor tissue into the blood or lymph stream, and a sufficient time has elapsed to make our observations on this point reasonably trustworthy.

IRRADIATION OF THE AXILLA

Early in the course of our study the axillae were not irradiated interstitially, reliance being placed upon external irradiation alone for the treatment of the nodes in this space. Later, the axilla as well as the mammary tumor was treated by interstitial implantation. The arm was abducted to a right angle, one hand of the surgeon pressing against the inner aspect of the arm in the effort to displace outward the axillary vein and accompanying brachial plexus.

Adequate and effective irradiation of the axillary space by interstitial irradiation is a most difficult practical problem. Up to the present time, we have been unable to develop any principle of dosage on the basis of a sphere which will approximate the accuracy of implantation in a tumor of the breast. Interstitial irradiation of the axilla was carried out whether the nodes were or were not palpable. The dosage employed has varied considerably, according to the size of the patient and the size of the nodes present in the axilla. Where large nodes could be palpated, they have been treated as spheres as with the mammary tumor. In all other instances, we have endeavored to irradiate the entire axilla, placing the seeds from the apex of the space to its base, also, along the under margin of the pectoralis major and over the insertion of the latissimus dorsi muscle. The doses introduced into the axilla varied from 16 to 39 millicuries, using seeds of a strength of 2 to 3 mc., the usual dosage being from 24 to 28 mc.

Ten of the patients subjected to radical amputation, who had received gold radon implants in the axilla, furnished pathological material, the study of which could serve to determine the adequacy of this form of irradiation for metastases to axillary nodes. In

one-half of the patients, viable tumor tissue could be recognized in the nodes removed. In 2 other instances, invaded axillary nodes showed marked atrophy of tumor cells, suggesting that a fairly complete devitalization had been accomplished. In 3 of the patients no report was made on the condition of axillary nodes, histologically. This group is too small upon which to base conclusions, but the findings in the laboratory, coupled with our appreciation of the difficulty of adequate and satisfactory implantation, indicate that our irradiation was probably ineffective in this region.

In 3 of the primary operable cases subjected to local mastectomy only, interstitial irradiation was used in the treatment of the axilla. In the 6 patients in whom surgery was withheld, 3 received interstitial irradiation into the axillary space. Satisfactory regression of the axillary disease followed, but no dissection of the space was carried out, and therefore no pathological data could be obtained.

In one instance in which 21 mc. was introduced into the axilla, using seven gold seeds, a disturbing neuritis developed along the course of the brachial plexus. Pain appeared two weeks after the introduction and an increasing disability of the arm developed. Operation was postponed for three months and then radical amputation was performed in the hope of relieving scar tissue pressure upon the plexus. At operation, three seeds were found in close proximity to the axillary vein and adjacent plexus. It spite of the scar tissue present, a satisfactory dissection was made and the wound healed by primary union. Although this operation was performed over nine months ago, a neuritis still persists with some considerable degree of disability. Neuritis is caused, undoubtedly, by the implantation of seeds at the apex of the axilla, bringing them into close proximity to the plexus, and can be prevented if this step is omitted. Moreover, if the disease has invaded the very summit of the axilla, it is incurable by any known method.

DOSAGE EMPLOYED WITH RELATION TO TUMOR DEVITALIZATION

Carcinomas of the breast differ widely with respect to radiosensitivity, and if this quality of a tumor could be completely known before interstitial irradiation was applied, a dosage commensurate with radiosensitivity might be developed. At the present time, all that seems possible is to select for a tumor a dose which will care for the most radioresistant type of mammary cancer.

A marked variation in dosage was used in the series under discussion, but one should bear in mind that a clinical study was being carried on without preceding data as a guide. In handling the smaller tumors it is possible to give a surprisingly large dose without undue damage to normal surrounding structures. When, however, one is attempting to treat adequately a large mammary cancer by interstitial irradiation the problem becomes more complex and difficult. With some of the larger tumors, it is practically impossible to devitalize completely the tumor by interstitial radon without causing serious damage to the skin, subcutaneous tissue and subjacent structures. In a considerable number of cases large vesicles formed in the skin overlying the breast and the ensuing ulcer did not heal until several weeks later. In large fat breasts, the tumor bed of adipose tissue undergoes an inflammatory reaction, and cases of this type are often unsuitable for interstitial irradiation. The method of gold seed implantation is therefore most readily applicable to tumors up to 5 or 6 cm. in diameter. In the large tumors, the method of implantation of gold radon wires, devised by Dr. George T. Pack and being presented by him today, supplies a more homogeneous and effective irradiation than does the use of gold radon seeds. We believe that this technique may become the method of choice for tumors of larger dimensions.

Local mastectomy was performed in 3 of the patients in the primary operable group,

furnishing additional data upon the subject of tumor devitalization. The first of these patients, a woman, aged forty-five, with a tumor 10×9 cm., received 1,000 per cent S.E.D.; a second 1,720 per cent S.E.D.; and a third 2,000 per cent S.E.D. Practical devitalization of the tumor was accomplished in the last two instances, but the case receiving the smaller dose still showed viable tumor cells in the specimen removed.

The tumors have been categorically divided according to their size, into three groups, in order that one may visualize better the type of tumor being treated, and have a clearer picture of the amount of radon implanted. Tumors 3 cm. or less in diameter have been designated as small, up to 6 cm. in diameter, medium, and above these dimensions, large.

The dosage employed in the small tumors varied from 760 to 1,900 per cent S.E.D., in 5 instances varying from 1,200 to 1,500 per cent S.E.D. In the previous communication, the conclusion was reached that a dosage of 1,200 per cent S.E.D., was necessary to destroy a radioresistant mammary cancer. The smallest doses employed in interstitially irradiated tumors of 3 cm. or less were 760, 900 and 1,000 per cent S.E.D., and in no instance did we find that the tumor was completely devitalized. On the other hand, when a dose of 1,200 per cent S.E.D. or more, was used, practical devitalization of the tumor was accomplished, so that one may fairly consider this an effective devitalizing dose for the smaller tumors, and a large dose unwise and unnecessary.

In tumors between 3 and 6 cm. in diameter the dosage employed varied from 650 to 2,400 per cent S.E.D. One case in this group which received a dosage of 940 per cent S.E.D., for a tumor 5.5×3 cm., showed complete destruction of the tumor, which was a cellular carcinoma and therefore probably highly radiosensitive. Another tumor of radioresistant type received 1,265 per cent S.E.D. and did not show complete tumor destruction. In general, when a dosage of 1,200 per cent S.E.D. was employed, complete devitalization was accomplished, but we believe that 1,300 per cent S.E.D. may be required to completely destroy the most radioresistant tumor of these dimensions. This method of gold radon implantation appears, therefore, equally applicable to tumors 3 to 6 cm. in diameter.

Larger tumors are unsuitable for the method.

WOUND HEALING

Interstitial irradiation should never be employed where any degree of infection exists in the tumor, a complication not infrequent in the presence of superficial ulceration. Such an infection is aggravated when gold radon seeds have been implanted, and may persist for a considerable time. Moreover, the tumor itself undergoes less satisfactory regression and disintegration. Large adipose breasts heal more slowly following surgical intervention if interstitial irradiation has been used.

Delayed wound healing following radical amputation occurred in 10 of the 21 cases in the primary operable group in which surgical intervention followed interstitial irradiation. In the 3 patients subjected to local mastectomy in the primary inoperable group, secondary wound healing was encountered twice. The 24 cases subjected to surgery following interstitial irradiation showed, therefore, 50 per cent unsatisfactory wound healing.

An analysis of the cases reveals that the major factors determining wound healing are:

1. Excessive interstitial irradiation.
2. Undue wound tension because of the sacrifice of a considerable area of skin, followed by an attempt at closure.
3. A short time interval between the employment of interstitial irradiation and radical amputation, and this is the most important of the three.

EXCESSIVE INTERSTITIAL IRRADIATION

One patient in the primary operable and 2 in the primary inoperable group showed delayed wound healing which could be

fairly attributed to an overdosage of the tumor by interstitial radon. The first of these, a primary operable case with a tumor 5×4×3 cm., received 1,850 per cent S.E.D. with interstitially implanted radon. A period of eight and one-half months elapsed before radical mastectomy was possible because of the presence of an extensive aggravated dermatitis. Following the operation, the dermatitis persisted and the wound did not completely close until several weeks had passed. Of the 2 patients in the primary inoperable series, the first received 1,720 per cent S.E.D. of interstitial radon, a period of six weeks elapsing before amputation was undertaken. The second received 2,150 per cent S.E.D., a period of forty-four days ensuing between interstitial irradiation and surgical intervention. Considering this long time interval between irradiation and operation in three patients, one may safely conclude that the delayed wound healing was due to excessive interstitial irradiation.

WOUND TENSION

Two patients in the primary operable group who received approximately 1,200 per cent S.E.D., in whom the time interval elapsing between the implantation of gold radon seeds and radical amputation was six and seven weeks, respectively, developed considerable necrosis along the wound edges with a subsequent low grade infection. In each instance a large amount of skin had been removed in performing the radical amputation, and although the wounds were completely closed by the use of Stewart submarine tension sutures, unwise and undue tension of the skin was evident at the termination of the operation. Excessive wound tension can, therefore, reasonably be assigned as the cause of the secondary wound healing in these two patients. A review of these cases strongly suggests that a partial wound closure, without tension, would have resulted in primary union in the sutured portions of the wound.

A SHORT TIME INTERVAL BETWEEN INTERSTITIAL IRRADIATION AND SURGICAL INTERVENTION

Six of the primary operable patients in whom secondary wound healing was encountered had not received an excessive dosage of interstitial radon, nor was undue wound tension a prominent feature. The dosage employed in these 6 instances varied between 635 and 1,500 per cent S.E.D., but an interval of only three to five weeks was allowed between gold seed implantation and surgical intervention.

The following table indicates the dosage used and the time interval before operation in these 6 cases:

SECONDARY WOUND HEALING

1. 635 per cent S.E.D. Interval 29 days
2. 650 per cent S.E.D. Interval 36 days
3. 1,000 per cent S.E.D. Interval 20 days
4. 1,000 per cent S.E.D. Interval 27 days
5. 1,200 per cent S.E.D. Interval 21 days
6. 1,500 per cent S.E.D. Interval 36 days

A review of these cases has convinced us that the inflammatory reaction induced by the implanted radon had not completely subsided before surgery was undertaken. The conclusion seems justified that a period of six weeks should elapse from the time of interstitial irradiation to operative interference.

Within certain limits a large dosage in the tumor may not result in unsatisfactory healing of the wound, if a long interval of time has been permitted before surgery is undertaken, as the table on the following 4 patients illustrates:

PRIMARY UNION

In spite of excessive dosage, but with adequate time interval

1. 1,625 per cent S.E.D. Interval 42 days
2. 1,800 per cent S.E.D. Interval 68 days
3. 2,060 per cent S.E.D. Interval 70 days
4. 2,400 per cent S.E.D. Interval 42 days (111 millicuries)

Primary wound healing will be obtained in tumors of 6 cm., or less, in diameter, if a dosage of 1,200 or 1,300 per cent S.E.D. is employed, when no undue wound tension

is permitted in the closure and if six weeks is allowed between irradiation and surgical intervention.

RESULTS

The results obtained in the treatment of 21 primary operable cases are shown in the following table:

RESULTS—PRIMARY OPERABLE CASES

	No Evidence of Disease	Alive—Recurrent	Dead
Interstitial irradiation Radical amputation (21 cases)	18	1	2
Interstitial irradiation Local mastectomy (3 cases)	3	0	0
Irradiation alone (6 cases)	3	1	2
Total—30 cases	24	2	3

A study of the table reveals that of the patients treated by a combination of irradiation and radical surgery, there is a survival to date of 86 per cent with no evidence of the disease. The patients must be followed further for a considerable period of years before the final results may be determined. The individual alive with recurrence is a young woman thirty-nine years of age who had a mammary tumor 7×6.5 cm., with invaded axillary nodes and was graded B by the clinical index of malignancy. She has been under observation for one year and nine months. Sixteen months after the beginning of treatment, she developed extensive metastasis to the bones of the pelvis with a small recurrent nodule close to the scar. Although her disease is widespread, there is no loss of weight or strength at the present time. Such a diffuse metastasis, appearing so long a time after treatment, is unquestionably not due to the method of interstitial radium implantation, but, rather, to a fulminating type of the disease.

Of the two patients who have succumbed, the first was a woman fifty years of age with a tumor 5.5×5 cm., of rapid growth, invasion of the axilla and a grade C index (highly malignant). She died eleven months after treatment, from what was reported to be a bronchopneumonia, but we strongly suspect it was a pulmonary metastasis. The second patient who died was a young woman thirty-four years of age, with a tumor 8×5×3.5 cm., of rapid growth, with extensive axillary metastasis. This was of the grade C, highly malignant, type. She succumbed one year and six months after the beginning of treatment, with widespread metastasis of the lungs and osseous system. In this instance, also, the course of the disease was the usual one in cases of this grade of malignancy, and the date of death was too remote from the onset of treatment to have been due to dissemination from interstitial implantation.

The 3 patients treated by interstitial irradiation, combined with local mastectomy, are all alive to date with no evidence of disease. Two of these were of advanced age, in whom it seemed reasonable to withhold the more radical procedure. The third was a younger woman, aged thirty-nine, with a small tumor and no axillary involvement, who was strongly opposed to a radical amputation. One was a grade A case, and two were in the lower range of grade B malignancy, which probably explains the satisfactory result to date.

Six of the patients in the primary operable group were treated by irradiation alone, operation being withheld because 4 of them were of advanced age, while the remaining 2 were young women with rapidly growing, fulminating disease of the grade C type, one of whom refused any form of surgery.

Three of these patients are alive, with the disease inactive, for periods varying from one year and two months to one year and eight months. A fourth, thirty-nine years of age, with a tumor 7×6.5 cm., of rapid growth, with axillary metastasis, is now probably recurrent with extension of the disease to the pelvic bones, the symptoms referable to this region appearing one year from the beginning of treatment.

Roentgenograms have thus far failed to reveal a pelvic bony metastasis. The fifth patient was forty years of age,with a tumor 7.5×7 cm., of rapid growth with extensive axillary disease. She succumbed to chest metastasis eight months after treatment, the pathological report being infiltrating carcinoma. Experience with the method has convinced us that disease of the type present in these younger women, with large tumors and extensive axillary disease, is unsuitable for interstitial irradiation. The sixth patient was sixty-seven years old, with a tumor 6×4.5×2.5 cm., the course of the disease being rapid from the onset. She died one year and three months after treatment, the cause of death being unknown. This group of primary operable patients, treated by irradiation alone, is too small from which to draw dependable conclusions.

PRIMARY INOPERABLE CASES

In the treatment of primary inoperable mammary cancer, experience has shown that in the presence of metastasis to the chest or osseous system, interstitial irradiation had best be withheld, reliance being placed upon external irradiation. Vigorous therapy, applied interstitially, would hardly appear justifiable when a palliation of such widespread disease is the best that may be hoped for. Moreover, many of the cases in the primary inoperable group, with ulcerative mammary lesions, are unsuitable for treatment by the interstitial method, because of the infection already present.

The results obtained in these 11 primary inoperable cases are shown in the following table:

RESULTS—PRIMARY INOPERABLE CASES

Disease Inactive	*Disease Active*	*Dead*
3	2	6

Of the 3 with inactive disease at the present time, the first is a woman forty-nine years of age, who had a small mammary tumor with metastasis to the axilla and chest. The breast and axilla were treated externally with roentgen rays, the lesion of the breast receiving 400 per cent S.E.D. of interstitial radon. No treatment was applied to the pulmonary disease. Histological examination showed the tumor to be an infiltrating duct carcinoma with gelatinous degeneration. The mammary tumor disappeared completely. It is now one year and eleven months since treatment was instituted and the whole process is apparently quiescent. The second patient was forty-eight years of age with two small tumors in the breast, each approximating 3 cm. in diameter. There was no invasion of the axilla but roentgenograms revealed a metastasis to the lungs. She was treated entirely by interstitial irradiation, receiving 900 per cent S.E.D. in the breast and 28.4 mc. of gold radon seeds into the axilla. Biopsy after irradiation revealed a few isolated hyperchromatic cells in dense scar tissue. Complete regression of the tumor followed irradiation. She has gained in weight and is now without evidence of active disease one year and six months since the beginning of treatment. The third was a patient thirty-seven years old with a tumor 6 cm. in diameter, with axillary disease and metastasis to the lungs and pelvic bones. She received external irradiation with high voltage roentgen rays to the breast and metastatic areas, and 1,275 per cent S.E.D. with gold radon seeds in the breast. Biopsy showed a small cell, highly malignant infiltrating duct carcinoma. The tumor completely disappeared and the disease has remained inactive for one year and four months.

Of the two cases in whom the disease is active at present, the first is sixty-eight years old with a mass 4×2.5 cm., without invasion of the axilla but with metastasis to the chest and pelvic bones. She received external irradiation with high voltage roentgen rays to the involved areas, and 960 per cent S.E.D. with gold radon seeds into the mammary tumor. Biopsy after external irradiation showed a fibrocarcinoma. The lesion of the breast disappeared but the metastases to the lungs and osseous system are progressive and now, one year

and five months after treatment, a node in the corresponding axilla is readily palpable. The second is a woman seventy-three years of age with a tumor 3.5 cm. in diameter, small invaded axillary nodes, as well as metastasis to the nodes at the hilus of the lungs. Because of her age, the only treatment applied was 1,360 per cent S.E.D. into the mammary tumor and an implantation of 13.7 mc. of gold radon seeds into the axilla. Biopsy ten days after irradiation showed carcinoma in scar tissue. The mass in the breast was replaced by scar tissue and the axillary nodes disappeared. Ulceration at the site of the mammary tumor appeared one year and three months after treatment. At the present writing, one year and eight months following interstitial irradiation, there is obvious activity in the mammary lesion and the nodes at the hilus of the lungs are increasing in size.

Six patients in the primary inoperable series have succumbed to the disease, 3 of them being cases upon whom a palliative mastectomy was performed because of ulceration induced by interstitial irradiation. A survey of these 6 cases shows that the disease was widespread when first they were seen and that the interstitial irradiation employed may have shortened their lives.

Cases which are just beyond the borderline of operability, because of the invasion of supraclavicular nodes, and in which the mammary tumor is under 6 cm. in diameter, appear suitable for a combined treatment by external and interstitial irradiation. Those with a single metastasis to bone, without extensive mammary disease, may also be selected for treatment by this technique. The presence of ulceration or infection constitutes a contraindication to its use. Employment of this method of irradiation in well-chosen cases of primary inoperable carcinoma will, we believe, yield a more effective palliation than could be obtained by the use of external irradiation alone.

The use of the aspiration biopsy technique developed by Martin and Ellis of the Memorial Hospital staff, or the employment of the Hoffman punch, furnishes adequate material to make a histological diagnosis of mammary cancer. This method is of special value in proving the presence of cancer in cases selected for irradiation alone, and such proof should be obtained if the end-results are to be considered trustworthy.

The histological changes induced by irradiation and the subject of radiosensitivity in mammary cancer were described in such detail by Dr. Stewart in our former paper that these subjects will not be discussed here.

PULMONARY FIBROSIS

The marked inflammatory reaction attendant upon the use of the method have raised the question as to whether or not extensive intrathoracic fibrosis might not have been induced because of the excessive dosages employed. Roentgenograms of the chest have been made of the vast majority of the cases treated, and in but two instances have we been able to discover any evidence of fibrosis within the pleural cavity, these plates having been carefully studied by Dr. Herendeen, the roentgenologist of the Hospital. These two cases were of the primary inoperable type with extensive disease at the time of admission, both having some metastasis to the chest and one, also, distant metastases to the bones. In one patient a dosage of 900 per cent S.E.D. was used and in the second 1,275 per cent S.E.D. Immediately underlying the implanted seeds one could detect a slight well-defined cloudiness covering an area of 6 or 8 cm. in diameter, which could be interpreted as a pleural thickening beneath the treated area. One may safely conclude that the use of interstitial irradiation presents no menace to the patient from the standpoint of inducing serious pulmonary fibrosis. Moreover, the menace of the lethal disease being treated is far greater than that of a possible very limited intrathoracic fibrosis.

PREOPERATIVE INTERSTITIAL IRRADIATION

Experience with the cases in this series has convinced us that interstitial irradiation should not be proposed as a routine preoperative procedure in the treatment of primary operable mammary cancer, for the following reasons:

1. A considerable degree of discomfort may attend the use of the method.

2. The postponement of operation for six weeks is disturbing to the patient.

3. The added expense is also a matter of importance.

A tractable patient with a small mammary tumor, with or without low axillary metastasis, is a suitable case for the use of the technique. In spite of the disadvantages attendant upon the method, one must realize that we have scarcely gone beyond the experimental stage in applying this treatment to mammary carcinoma. Devitalization of the tumor should furnish, on theoretical grounds, a better ultimate result, and the follow-up upon these cases with the addition of others treated by the method may demonstrate that it is the most effective treatment yet at hand. We propose to continue the use of this preoperative technique in patients of the type which we have indicated.

IRRADIATION ALONE IN THE TREATMENT OF PRIMARY OPERABLE MAMMARY CANCER

The technique which has been employed is proposed as a substitute for radical surgery alone, or combined with irradiation, in the treatment of mammary cancer. It can safely be advised and employed in well-selected cases where operation is contraindicated because of advanced age, the presence of intercurrent disease, such as diabetes or active tuberculosis, or when the patient herself is unwilling to submit to radical amputation. The evidence at hand is sufficiently impressive and abundant to justify the use of the method in primary operable cancer of the breast. It should not be used if ulceration or infection is present, if the tumor is larger than 6 cm. in diameter, if the disease is a diffuse, infiltrating duct type, if one is dealing with an inflammatory carcinoma or if the mammary gland is of the large adipose type.

SUMMARY

1. Interstitial irradiation effectively devitalizes mammary cancer.

2. The implantation of gold radon seeds should be preceded by high voltage roentgen therapy.

3. The treatment should be completed in three weeks.

4. The devitalizing dose for the most radioresistant tumor 3 cm. in diameter, or less, is 1,200 per cent S.E.D.

5. The devitalizing dose for the most radioresistant tumor 3 to 6 cm. in diameter is 1,300 per cent S.E.D.

6. The method is unsuitable for tumors larger than 6 cm. in diameter.

7. Interstitial irradiation of the axilla is a difficult practical problem.

8. If the radon seeds are implanted at the apex of the axilla, serious neuritis may follow.

9. The implantation should be confined to the lower two-thirds of the axilla.

10. Dissemination of the disease from interstitial irradiation has not been observed.

11. Delayed wound healing is due to one of three factors:

(*a*) Excessive interstitial irradiation.
(*b*) Undue wound tension.
(*c*) A short time interval between interstitial irradiation and surgical intervention.

12. Eight-six per cent of the primary operable group treated by interstitial irradiation and radical surgery are alive, without disease, one year and six months after the beginning of treatment.

13. Primary inoperable cases just beyond the borderline of operability are suitable for the method.

14. Serious pulmonary fibrosis is not induced by its use.

15. The technique should not be proposed as a routine preoperative procedure.

16. A five-year follow-up on these cases, and additional ones, may demonstrate that the technique is the most effective treatment yet devised for mammary carcinoma.

17. Interstitial, combined with external, irradiation, without the use of surgery, can safely be advised and employed in well-selected primary operable cases.

DISCUSSION OF SYMPOSIUM ON CARCINOMA OF THE BREAST

Dr. James Ewing, New York City. I think the Society is to be congratulated upon having listened to a series of papers which for scope and completeness might well be a part of an international conference on this subject. It seems to me the detailed and comprehensive character of the papers this morning, and the size of the field they cover, would lead one to the conclusion that the modern handling of mammary cancer is a specialty which may well call for the entire energies of men of large ability. That is the way in which improved results in this field are mainly to be secured. The expert surgeon may remove the breast, the expert radiologist may give his treatment, but the man to decide what shall be done must be the man in the organization who can command all these resources.

Time will not permit me to speak of all of the papers and many of you are better qualified to speak on this subject than I. I was greatly interested in Dr. Pfahler's report of improved results with improved technique, and I think he will agree with me that the end is not yet in the improvement of the methods of irradiation.

Dr. Portmann's contribution is of importance as a definite proof, where proof is difficult to procure, of the value of observations on a large series of miscellaneous types of mammary cancer and in which there is still doubt in organizations not radiological.

The question of sequelae following heavy external irradiation, as in the cases of fibrosis of the lung, is important. We must admit that heavy irradiation of the type described may produce this fibrosis of the pleura, and sometimes fibrosis and atelectasis of the lung, but I should think from Dr. Fike's report that they are not often of serious import to the patient. Of course there are serious results from irradiation, both temporary and permanent, and those are taken account of by the operator. Perhaps the most important revelation of Dr. Fike's report is to emphasize the importance of the man in charge of the case visualizing the condition of the patient ten years from now, and then deciding upon the technique. I have seen only one severe pulmonary fibrosis and that was in a case that was treated over a long period on the diagnosis of pulmonary tuberculosis. The patient died of another disease and there was no sign of tuberculosis or that there ever had been.

Dr. Adair's paper revealed the great complexity of the conditions one has to deal with, in advanced or complicated mammary cancer. It is discouraging to realize how many of these complications are the result of treatment.

I believe Dr. Pack's method of introducing linear radiation is far superior to gold seeds. We are indebted to our physical department for furnishing us with unquestioned physical data. They state that without question the thing to do is to place the radiation in the center of the sphere. But when you do this you produce a condition that is of great importance in the healing process. Practically, it is very difficult to place gold seeds in the central area, and I have seen bad results from crowding these seeds into one close point. From the practical standpoint I welcome Dr. Pack's method and think it can be made much more effective in destroying the disease. We cannot be sure of the extent of the tumor. There are occasionally multiple foci in the breast.

I also think that slow, continuous irradiation of low intensity is the better method to be employed in these tumors. I should say that with the exception of the very small tumor the day of the gold seed has passed and that other methods have replaced it.

Dr. Lee is making a bold attempt to treat suitable cases of mammary cancer by radiation alone, but the chief difficulty he encounters is the position occupied by surgery in this field. I do not wish to depreciate in any way the importance of surgery in mammary cancer. It is our main reliance. Yet it stands in the way of effective efforts in radiation therapy. Dr. Lee encounters serious psychologic difficulties. He has to consider the family of the patient, the

psychology of the patient, and many other things that have nothing to do with the treatment of the tumor, before he can decide on irradiation and carry it out consistently. I feel that as long as one is required to protect himself against criticism and error in this way, radiation treatment of cancer of the breast will not make very rapid progress. On that question I have been very greatly impressed by the courage Mr. Geoffrey Keynes of London, supported by Lord Moynihan, who say, that they will treat all their cancers of the breast by vigorous radiation and nothing else. I was surprised that this radical departure could be put over in London, but I doubt if it can be done at present in this country.

I am not particularly interested in the radiation treatment of cancer as a preoperative measure. It is undoubtedly of value but it does not go far enough. The ultimate aim should be to cure suitable cases by irradiation alone.

An important consideration is the added expense, pain, delay, and misery which the patient must experience to get the modern methods of treatment. Yet women will go through a great deal in order to save their breasts. It has been shown that irradiation can destroy many of the tumors within the breast, the great problem being the axilla. It will be a great help when women know that through radiation therapy they need not lose their breasts. They will then come early to the doctor.

In the modern development of the treatment of mammary cancer first attention should be given to reducing the penalties exacted from the woman who develops this disease.

Dr. Henry K. Pancoast, Philadelphia. Those of us who have been in this Society since its incipiency can remember the very unscientific radicalism which characterized some of the presentations of many years ago. Those of yesterday and today have been characterized by another type of radicalism which is based on very careful and accurate scientific investigation. It is no doubt new to many outside the membership of this Society, but most of us know what has been going on during the last few years to lead up to the surprising statements we have heard. The presentations in this symposium have been most interesting to us, but unfortunately we are a little group to ourselves and the information we have heard will not be carried to those who need to hear it most. Certainly this is a subject which should have careful consideration by the medical profession in general and particularly by surgeons. Its discussion brings out the question of cooperation between the exponents of two methods of treating cancer. We are realizing more and more each year that only through the close cooperation by all those concerned can we hope to give the cancer patient a really square deal.

The surgeon, as a rule, does not appreciate the physical problems which are involved in the radiation treatment of cancer. We must realize that these physical problems have been carefully worked out and are understood by certain groups who are dealing with cancer from every point of view of rational therapy.

We have heard some very good statistics which have gone far to prove that by external irradiation alone the longevity of the patient with breast cancer is prolonged. These statistics have been compiled by men who have been long in the work, and whose technique is well developed. Unfortunately, the technique and results of all men are not the same, and if we compiled the statistics of everyone engaged in cancer therapy they would not show up so well. To my mind, the only statistics that will be of any value in the future are those which will show the methods used by those men who obtain the best results, and those methods must be carefully studied and taught and must be used by all, for no one can get good results unless he uses methods which have been proved to bring about good results.

We have learned by experience that external irradiation alone in breast cancer does not accomplish what is desired. When we realize the enormous dosage which is required to destroy cancer cells in the breast we can understand why curative results by external irradiation are restricted to a comparatively small number of cases.

In a group of cases treated a number of years ago by preoperative irradiation we did not obtain the results which seemed to justify the procedure. We realize now that it was because we could not deliver sufficient irradiation externally. For that reason we discarded that method of treatment. I think the treatment did no particular harm, unless it delayed operation.

We must regard the palliative effect of irradiation as of just as much importance in its sense of doing good as the attempt to cure cases which can be cured. We see no cases which require palliative irradiation more than

those which have metastases in the bones. This is a painful, difficult and crippling condition, especially when pathological fractures occur. We know that considerable improvement and even arrest of the disease may be brought about by irradiation of bone metastases. We should never cease in our attempts to relieve these patients of suffering.

Dr. Ralph E. Herendeen, New York City. Just where does the radiologist stand in this series of cases and of what value is roentgenology here? It would appear from what has been said that any method of irradiation to cure or control carcinoma which does not include roentgen therapy in a very major part is apt to prove rather disappointing. There is no point in discussing the value of roentgen therapy in primary, inoperable carcinoma of the breast. That has been demonstrated repeatedly. Nor is there anything to be gained by going into the value of roentgen therapy in metastases. Its value here is extended year by year, but in order for us to advance its application it seems to me we must emphasize the rôle it may play in the treatment of primary operable carcinoma. It is difficult for me to visualize irradiation by radium alone in this field, either preoperatively and certainly postoperatively. It may be that in the treatment of the small, well-localized tumor radium may accomplish all that is desired in the preoperative treatment, but I can see little value of radium here when we understand that the breast is to be removed entirely without touching the local tumor, and I further understand that well-performed operations in well-selected cases of primary carcinoma of the breast are not followed by local recurrences. It seems to me that to employ roentgen therapy intelligently in the preoperative treatment of carcinoma of the breast, it is a mistake to focus all of our attention on the primary tumor. The irradiation of the outlying areas, well beyond the breast, the axilla and supraclavicular areas, not forgetting that the disease disseminates beneath the tumor along the intercostal lymphatics, is something we cannot ignore.

I question the statement that roentgen therapy must play a secondary part in the radiation treatment of primary, operable carcinoma of the breast, and I should also like to see figures which prove that a considerable percentage of well-selected primary operable carcinomas of the breast cannot be handled adequately by the roentgen ray alone. It may be true that radium used locally in such cases would be of great value in destroying the primary tumor, but yet that is not the only thing to be accomplished. We are devising many methods continually for the destruction of the local tumor. It is a surgical idea, an idea of radiation applied by surgeons for destruction of the local tumor. This they have been doing for a long time by complete, radical removal of the breast. That is not my line of thought, and I do not believe we will get very far in pursuing that line. Rather would I see more intensive efforts made to treat carcinoma of the breast in well-selected cases by roentgen therapy alone, and not with the idea of attempting there a single series of exposures to destroy in the beginning the local tumor. I think the destruction can be accomplished from time to time by repeated series of treatments, and the only one I think can judge as to the dosage needed, the number of exposures to be employed, the time interval and the effect of the treatment, the one who certainly should play an important part in the question, is the roentgenologist, along with the help of the surgeon.

Dr. Damon B. Pfeiffer, Philadelphia. I have no quarrel with radiation. I am thoroughly convinced of its value. I believe in postoperative irradiation and am willing to accept the data which show the largest survival of patients who are irradiated after operation. Of its palliative value there can be no doubt, but there is a great difference between palliation and cure. We must think clearly along these lines and especially since there seems to be arising in certain quarters a belief that the time has arrived to remove mammary cancer from the field of surgery and put it into the field of radiation. It is proposed to treat "suitable cases," meaning apparently early cases, those in which the disease is still confined to the breast. You must remember that those are the cases in which surgery gives its best results Moynihan, in a large series, showed 90 per cent of ten-year cures in just such cases. The radiologist complains that his percentage is depressed by the large number of unfavorable cases given over to him which are unsuitable for surgery. There is justice in this contention, but it must be remembered that surgery also accepts a large proportion of late cases in which end-results are sure to be poor because of the feeling that it is necessary to give the unfortunate patient any chance for cure however small. Until further evidence and a great deal of

it is forthcoming, I shall regard it as a calamity to withhold the excellent chance for cure offered by surgery to the patient with an early cancer limited to the breast. Surgeons long ago discovered that so-called recurrences are merely continuances due to the impossibility of complete extirpation. Is this fact fully held in mind by the radical radiologist who attempts to treat primary tumors, and is it possible with any technique to deliver the necessary 1,200 per cent skin erythema dose to the growing edge of malignant growths in order to insure freedom from recurrence? In view of the fact that the intensity of radiation diminishes with the square of the distance, how does it matter so much whether radiation is delivered from without or by means of various interstitial implants if the trained eye is focused not upon the growth but upon the many advancing columns of cells which are the real problem from the standpoint of cure? I would be willing to see trial of the method made objectively and under proper scientific control. I had the opportunity of seeing Keynes' work in London last summer and brought away the impression that it was carefully done, of great scientific interest, but impossible to evaluate at this time. Certainly, this Society cannot afford to spread the impression that it favors radiological treatment of mammary growths which are removable by surgery. In that direction lies, in my opinion, antagonism and eventual discredit to a valuable adjuvant.

Dr. Ira I. Kaplan, New York City. The question of carcinoma of the breast is very important, and we realize this when we get the results following both surgical operations and radiation therapy. In our position in caring for the carcinoma patients in the City of New York I think we have the largest custodial department in the United States. There every week we see new groups of patients who have new growths of cancer of the breast, who have been treated by radical surgery or radiation. We feel that a great many of them might better have died without the interference they had. In one branch of our service we have an opportunity of trying out some of our own thoughts in the matter and we, too, help along the steady stream to the custodial hospital by the radical methods we make use of.

Unfortunately, all surgeons are not as pleasant as Dr. Pfeiffer about talking the cases over with us. In a general hospital, where every surgeon is trying to do as much operative work as possible we do not have the fine cooperation they have at Memorial Hospital. The patients we get are those which the surgeon refuses to operate upon in most instances, or in which there are certain other contraindications to operation, but the results from general surgery do not contrast in any way as strongly as Dr. Pfeiffer makes us believe, with radiation.

Dr. Portmann and Dr. Fike have shown the results from radiation therapy. Dr. Fike called attention to some of the results following roentgen therapy. I think if this were carried out properly these things would not occur. We have never run across such cases since using the tangential dose advocated many years ago. In the hopeless cases we find many times that palliative treatment does not do much good.

We find a large number of hopeless neuritis cases, the arm being involved following mastectomy. We cannot explain this away. We have gone so far as to ask the surgeons to reoperate and try to remove the growth around the nerve, with possible relief.

In the treatment of primary carcinoma of the breast we are using some new type needles, which we started in 1924, and in contrast with Dr. Pack and Dr. Lee, we feel that the work can be done with heavy needles well filtered, although their work is so splendid. I think it all depends upon the careful placement of the needles.

(Presented lantern slides.) We can speak very freely of implanting radon seeds and gold seeds or wires in the axilla to control the nodes, but this is very difficult without causing destruction. I think the neuritis is due to the fact that we cannot avoid injuring the lymphatics. The newer type needles are 6 cm. in length, with an 0.6 mm. platinum wall thickness. They carry 3 mg. of radium, in each needle. They are implanted in and around the lesions so as to cover the entire surrounding area, and at the same time irradiate around the whole breast region.

I am sure that irradiation when properly controlled can control carcinoma just the same as surgery can control it, and if we will use the same criteria for radiation therapy that they do for surgery I think we can get the same results.

Dr. George M. Dorrance, Philadelphia. For the patients who will not submit to surgery I think the implantation of radium applicators should be thought of and taken care of very carefully. I think deep roentgen therapy for

axillary nodes has not given as satisfactory results.

Dr. William Neill, Jr., Baltimore, Md. Dr. Pfahler's results, so far as I know, are not equalled by others.

The best surgery offers in carcinoma of the breast, with no palpable glands, is a five-year cure rate of 50 per cent. When only one gland is involved it drops to 20 per cent, and with more extensive axillary involvement cures are exceptional. I feel that postoperative irradiation, either with roentgen rays or radium, in proper hands, will increase the percentage in both groups.

For the advanced types, surface irradiation, together with interstitial irradiation, accomplishes a great deal from the standpoint of palliation which may last from a few months to several years. We do not advocate surgical incisions preparatory to laying in the radium or radon points, doing this instead through a small puncture in the skin under palpation. We advocate one or two stronger gold seeds rather than multiple smaller ones.

As cancer of the breast is prone to metastasize to the lungs and skeleton, this should be borne in mind preparatory to treatment in the advanced types. For the former we have seen no improvement by any types of irradiation, but in the latter decided benefit is obtained with regard to relief of pain and prevention of additional bony destruction. Radiation does not prevent ossification as often erroneously stated.

Dr. William H. Cameron, New York City. To sum up this question in a few words, too many physicians think that cancer is cancer, radium is radium and x-ray is x-ray, and it is our duty to teach them otherwise.

Dr. Pfahler (closing). I agree with Dr. Pfeiffer about teaching the public and the general practitioner that the matter of getting the patient in the early stage is of the greatest importance and I think in the clearly operable case the best chance is to operate and follow by irradiation; but there are, as Dr. Dorrance said, many patients who will not have surgery. There are other patients who will not tell their family, their husband, or their friends, that they have a lump in the breast because they are afraid of surgery. For those we can hold out a reasonable hope of cure without losing the breast. The primary thought is to get the patient well, and my own opinion is that where we combine surgery and irradiation we will get the best general effects. It has been admitted that when the glands are involved, the percentage of recovery drops to 15, but the general recovery reported in the literature is 22 per cent. Our own results are 53 per cent in that group. All of this material was examined in the pathological laboratory and it is 53 per cent.

As Dr. Cameron said, we must not look upon radium and the x-ray as elements of cure any more than we look upon the knife of the surgeon as the cure. They must be used with care and judgment in the hands of the well-trained man.

Dr. Lee (closing). I feel that the presentation of the Symposium on Cancer of the Breast has been of particular significance, in that three of the papers were presented by roentgenologists and three by surgeons, while the discussants included a pathologist, four roentgenologists and two surgeons. These presentations today should press home the wisdom of a group rather than an individual focusing upon the many problems surrounding mammary cancer.

The paper by Dr. Pfahler represents an important contribution giving the result of the irradiation of mammary cancer out of an experience of almost three decades. The figure of 46 per cent alive and without disease with a combination of radical surgery and postoperative irradiation is a higher figure than most surgical clinics have been able to achieve. Our own percentage of results with preoperative roentgen irradiation, radical surgery and postoperative irradiation is 39 per cent, while the figure from the average surgical clinic where radical surgery alone is employed is 35 per cent.

Dr. Fike's presentation of the subject of pleuro-pneumonitis following roentgen treatment is timely, and its chief value lies in the fact that the clinical observations received pathological confirmation. His contribution should serve as a warning to those applying roentgen rays or radium in the treatment of mammary cancer, to remember that all normal tissues coming within the area of treatment are changed permanently. Our effort at therapy must be directed to reduce this damage to the minimum. One must feel, however, that in treating such a lethal disease one is justified in running the risk of damage to normal structures in the effort to completely eradicate mammary cancer.

Dr. Portmann's paper brought up for our consideration the important topic of postoperative roentgen therapy, and his conclusions

are gratifying in that they seem to indicate that when postoperative roentgen irradiation is used following radical surgery, the five-year end-result percentage figures are definitely improved.

Dr. Adair's paper considered the important topic of the treatment of metastases and the inoperable patient. His results in the treatment of this group are gratifying. He has demonstrated the marked palliation which appropiate treatment may give to the hopeless cancer patient, particularly in the treatment of metastasis to bone. He has called attention to the difficulty which exists in applying adequate irradiation to the axillary and supraclavicular spaces, pointing out that only when diffuse irradiation is applied to the axilla where the disease is particularly radiosensitive, may one expect to obtain a satisfactory regression.

Dr. Pack's paper on the use of gold radon transfixion tubes is most interesting. It certainly provides diffuse irradiation for the entire mammary gland and the familiarity with the modes of extension of mammary cancer suggests that the entire gland must be irradiated, in addition to the tumor bearing area, if effective control by irradiation is to be obtained. The technique which is employed is simple, well conceived and represents without question a distinct advance in the application of interstitial radium in the treatment of mammary cancer.

Finally, I want to comment briefly upon the discussion by Dr. Herendeen who has brought up the question of the use of irradiation alone in the treatment of favorable cases of mammary cancer. With surgical statistics often disappointing, I feel that his point is fairly taken. A fair trial should be given in cases on the borderline of operability or patients in the younger age groups, for surgery seldom effects a cure in these types of the disease.

Dr. Pfeiffer has presented the viewpoint of the sound, well-balanced surgical judgment of the day, and I feel that the Society should be most grateful to him for his discussion. One must agree that, in general, his viewpoint is sound. Any attempt to control mammary cancer by irradiation methods alone should be carried on in an institution where a large amount of material will permit the proper selection of cases, and where the most complete case records may reveal the truth concerning the end-results.

ROENTGENOLOGIC AND LEGAL CONSIDERATIONS OF FRACTURES OF THE MANDIBLE*

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SUCCESSFUL reductions of fractures of the mandible require special treatment. Of all fractures of the body, those of the mandible are apparently the least understood, and as a general rule receive indifferent treatment. The mere reduction and splinting of a fracture of the jaw does not insure a successful outcome. Union will in time undoubtedly take place, but many other factors enter which have a bearing on the end-result. First and foremost, malocclusion will result from the slightest deviation and consequently interfere with proper mastication. In edentulous jaws alteration of the dentures can be made to accommodate for the deformity.

Perfect results cannot be obtained in all cases, but this is a plea for thorough examination and diagnosis with a complete understanding of the repair in order to avert unpleasant legal entanglements that some physicians and roentgenologists have had forced upon them.

The treatment of fractured jaws attained a certain degree of perfection in early times and some of the principles laid down by Hippocrates may be used successfully today. His thoughts on bandaging alone are invaluable and show that careful attention was given to reëstablishing the normal relationship of the parts. Undoubtedly a great number of his fractures occurred as the result of athletics, the same as is true today, but the changes of environment, with modern modes of transportation have altered the incidence of mandibular fractures. Reiter states that of 780 fractures admitted to Cook County Hospital during a six months' period, 50, or 6.5 per cent, were fractures of the jaw. Maitland, in a recent paper, gives the ratio of fractures of the mandible to those of the maxilla as 9 to 1. Review of 152 cases in the Department of Oral Surgery, University of Michigan Hospital, shows 38 to be maxillary and 8 combined maxillary and mandibular. Some writers place fractures of the jaw in sixth place in proportion to fractures of other bones of the body; others do not seem to think they are so frequent, but in all of the series studied, only fractures of the leg, arm, ribs and skull are more common. The statistics vary greatly with the different types of hospitals and the attention of the staff members to this type of fracture. There are two predisposing factors: age and environment.

Dunning's series of 1,065 cases, when compared to other compiled statistics, shows approximately the same relationship to age, that is:

years	per cent
1–10	6
10–20	8
20–30	28
30–40	32
40–50	17
50–60	7.5
60–	2.5

and the proportion as to sex as male 93 per cent and female 7 per cent. The outstanding causes are:

	Cook County per cent	Ivy per cent	Dunning per cent
Blow from fist	54	49	46.5
Automobile accident	10	8	20.7

During youth the undeveloped bone is more elastic, flexible, and not so easily broken. The mandible attains its full growth by the twenty-fifth year. From then until the period of senility, when there is a marked decrease in the size of the bone following extraction of numerous teeth and the increased deposition of lime salts, the

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calcium content of the bone is two-thirds its weight. The bone has therefore reached its maximum strength at the twenty-fifth year and is more likely to withstand the stress and strain of violent blows. The greatest number of fractures occur between the ages of twenty and forty, and during this age period the liability of impacts should be greatest. Fractures from assaults are more numerous than from all other causes combined and these of course occur during adult life. The overwhelming proportion of fractures falling within this age period leads one to partially disregard the influence of age or the idea that fractures of the jaw are due to any peculiar shape or structural characteristics of the bone, and to conclude that they are largely due to impacts alone.

If the horse-shoe shape of the mandible were a weakness then there would be a higher percentage of fractures of this bone. In fact this arch shape is stronger than the long bones.

The diagnosis of a fracture of the mandible cannot always be made from a clinical examination. The clinical findings should be well known to any surgeon, but even after a careful examination, a roentgen examination is indicated whether or not a fracture was discovered. It is of prime importance to determine first whether the fracture is simple, comminuted, multiple or compound. A broken mandible is less dangerous than a fracture of any of the facial bones. This is obvious when one considers that the mandible is attached more or less loosely to the cranium while the maxilla forms an integral part of it. Fractures of the maxilla may either directly or by transmitted force fracture the base of the skull. In making a diagnosis of fracture of the mandible it is important not to overlook a dislocation, either single or double, or as a complication.

Survey of a large number of fractures and a review of the literature show that the location of types of fractures is approximately as follows:

	per cent
Single	68
Double	31
Triple	1

The single fractures are located as follows:

	per cent
Angle	44
Mental foramen	30
Symphysis	9
Molar region	9
Neck of condyle	7
Condyloid process	1

Of all double fractures, 77 per cent are at the mental foramen on one side and the angle of the opposite, while all other combinations, ranging around 7 per cent each, make up the total. Pathological fractures of the jaw are not considered in these figures as they usually occur at the site of neoplastic involvement or are the result of extraction of an unerupted or buried molar which places the fracture line at the site of the weakened part by removal of the bone surrounding the tooth. With all compiled statistics showing that one-third of the fractures of the mandible are double, it is surprising how often roentgen examinations are made of only the side showing pain, tenderness and swelling.

The roentgen examination should cover the entire mandible, including both condyles and the mental process. The mandible being horse-shoe shape, open posteriorly but immovable from this position, breaks as a barrel hoop, immediately at the point of pressure and at two opposite points if the impact is sufficient. For this reason, a study of the entire arc should be made. Any suitable method to show the entire mandible may be used. In addition to the usual oblique and posteroanterior views we use two additional projections: one through the vertex of the skull, and another using a large dental film and directing the rays upward along the long axis of the lower central incisors in order to obtain both anterior and posterior portions of the mental process.

With the all-important feature of correction of occlusion, fractures of the jaw

Fig. 1. Ten days after fracture. Wire loop dental splint. Fragment of bone in line of fracture.

are treated as any other bony break. Fractures of the jaw involve many of the principles of treatment of the other bones of the body, but with special care of the mouth, knowledge of teeth, special splints and prosthetic appliances, the oral surgeon is much better prepared than the general surgeon for the care of such a case. Many cases receive only a type of the Barton bandage, which probably is of no more value than a simple bandage about a fracture of the wrist. Numerous methods are in use, but the general one and apparently the one used to the best advantage is fixation by wiring, with loops in such a manner that they may be cut by an interne or nurse in case of an emergency such as vomiting or bleeding. Proper occlusion is the ultimate aim, and attention must be given to points which interfere with proper healing. The roentgenologist can be of invaluable assistance in these cases by determining the location of the break, type, whether a tooth is in the line of fracture and if so how much of it is exposed and whether or not fragments are present. When there are teeth in the line of fracture each case is a special problem. Pulpless teeth should be extracted without question as they are a definite focus of infection and may set up an osteomyelitis. Since osteomyelitis is the most common complication and the most common cause of non-union, it should be avoided in every possible manner.

When there is a considerable loss of bone, such as is often seen after automobile accidents or gunshot wounds, there is a question of whether or not malocclusion will result if the ends of the bone are approximated. Bone grafts are indicated in such cases.

Failure of union is rare and the most common causes of delayed union are as follows:

1. Suppuration in the line of fracture due to denuded teeth.
2. Lack of early reduction of extremely displaced fragments.
3. Extensive loss of bone caused from the severity of the injury, viz., gunshot wounds, automobile accident.
4. Osteomyelitis and subsequent necrosis.
5. Systemic disorders, viz., syphilis, tuberculosis, anemia.
6. Tissue between the fragments.
7. Improper reduction and insufficient immobilization.

Delayed union or even non-union may occur with the fragments in practically normal position if the fragments are separated by only a small amount of tissue. Tissue between the fragments occurs most frequently when the fracture is posterior to the molar region.

Textbooks state that a fracture of the mandible will heal in from three to five weeks, but the literature shows the average time of fixation to be much longer. Dean gives forty-three days in normal cases, while those with systemic disturbances require two or three times as long. Most of his cases are sailors and "ship out" immediately after the splint is removed and require no further treatment. He quotes one case where there was good clinical healing although the roentgenogram

showed a marked loss of lime salts in the fracture site at seventy-four days. A subsequent roentgenogram six months later showed excellent osseous regeneration.

In a review of 50 unselected cases on the services of Dr. Chalmers Lyons, we find that the average time elapsing between the time of injury and surgical fixation to be seven days and the average time elapsing between fixation and removal of the splint to be forty-five days. That is an average total of fifty-two days between injury and removal of the splints. All of these cases are examined roentgenographically but splints are removed, when, in the opinion of the oral surgeon, there is clinically present a firm fibrous union. He does not continue to exert the force of pressure from mechanical contrivances which promote additional resorption of the bone. Roentgen examination is used subsequent to fixation primarily to give information regarding the apposition of the ends of the fragments and not to determine whether there is evidence of union present. Past experiences have proved that the roentgen findings may be misleading. Sufficient time must be allowed to elapse before we can hope to demonstrate a firm bony callus, and the impatient individual should be advised of this fact in order that he may understand the character of the union present. The patient is often greatly disturbed by the fact that the jaw fracture does not seem to progress as rapidly as other previous injuries he has had.

A point well worth consideration is that many patients are brought to a physician following an accident. Their cuts and contusions are thought to be of immediate importance and are attended to at once. The fracture of the jaw is overlooked as other injuries are more obvious and treatment of the jaw is a secondary consideration. This delay complicates the subsequent treatment, even though some temporary measures may have been taken. Such temporary measures are usually poorly applied and are of no value if there is any displacement of the fragments.

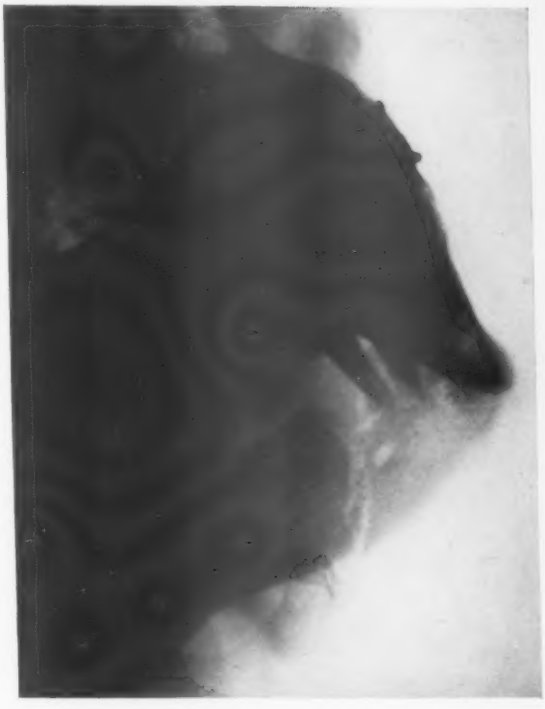

Fig. 2. Twenty-six days after fracture. Splint not removed. Resorption about fracture and area widened.

If we are to consider the roentgenologic appearance of a bone after a fracture and the reason for the appearance of non-union we must consider bone changes from a surgical standpoint, that is, those changes which can be demonstrated by the roentgen ray.

The two changes which are most commonly met, resorption and osteogenesis, are so closely linked together that it is possible to assume that the relationship may be a true law of ossification. Zones of rarefaction are found in the vicinity of the callus in repair of a fracture. Bone is a very unstable tissue as evidenced by its rapid dissolution in certain diseases and the rapid loss of lime salts under the influence of disuse. Resorption takes place under two conditions: osteoclasis and osteolysis. The first occurs by intervention of the osteoclast, a cell of speculative origin about which there are several theories as to its action. Only indirect and insufficient evidence points to the active specific agent in

bone resorption. The other process, osteolysis, is thought by Leriche and Policard to be only a disturbance of the chemical balance of the phosphocarbonates of lime

Fig. 3. One hundred and thirty-two days after fracture. Wires removed. Ends of bony fragment firmly attached and shadow of central portion not shown. No appearance of firm callus along line of fracture.

in a direction inverse to the fundamental ossifying disposition. They further state that "It should be regarded as a result of an increase of the soluble phase through the rupture of the fundamental reaction of ossification." The various factors causing this disturbed balance have not been determined. One factor, however, has been generally accepted: that is, that increase in blood supply aids resorption. The theory that bone atrophy occurred when insufficient circulation was present has been discarded. In cases such as an erupting tooth where there are periodic inflammatory processes there occurs a definite rarefaction. Changes in the connective tissue matrix, most frequently caused by pressure, have an influence on resorption. Where mechanical contrivances have been used in the repair of fractures, the influence of pressure is most marked. In the treatment of fractures of the mandible, one of the complications that is always present is muscle strain. In direct wiring of the fragments the forces exerted upon the fragments through muscle strain will cause a pressure resorption at the site of wiring which will neutralize the effectiveness of such a procedure if continued for too long a period. The same condition will exist if bone plates are used. In fact, any influence which disturbs the equilibrium of the stability of bone tissue will cause a rapid disintegration and bone resorption.

After resorption has taken place, osteogenesis must follow to cause a return to normal. The complexity of the structure and development is the one obstacle encountered in the solution of any problem in which bone alone, or associated with any other tissue, is involved. Bone resorption and osteogenesis are so closely allied that we believe that bone resorption or rarefying osteitis, as it is spoken of in bone repair, is a forerunner of the osteogenetic process. Just what takes place is a question of diverse opinion. Some ascribe to the periosteum a rôle of vascularizing, limiting membrane, others think that the periosteum is a membrane having either dormant or active properties of osteogenesis, possibly though only on the inner or epiosteal layer. In either case, retention of the periosteum is desirable in repair of fractures, especially in a vascularizing rôle. Aside from the periosteum, both the deep and superficial layers of bone are capable of osteogenesis under suitable stimulus. Axhausen has shown that the wide Haversian canals contain active osteoblasts and favorable conditions for new bone formation. It is a surgical procedure in some cases to stimulate bone repair by drilling holes through which granulation tissue pushes out and union of the fragments results. From this evidence we can assume that compact bone independent of endosteum or periosteum is capable of bone repair if it has proper blood supply.

When a bone is fractured considerable

blood will be effused from the ruptured medullary vessels, as well as from the periosteum. Also more or less blood is poured out from the lacerated tissues near the site of fracture. This blood coagulates and forms a fibrinous mass. When the fracture is reduced the periosteum resumes nearly its normal relationship to the bone, thus forming a tubular sheath which connects the ends of the fragments. The fibrinous coagulation of the effused blood imbeds the ends of the bones and this fibrinous network is soon invaded by fibroblasts and is organized and transformed into embryonic connective tissue. The periosteum becomes more vascular, thicker and softer. A thin layer of a viscous fluid is found beneath the periosteum for a short distance from the fracture line. The congestion present at this time not only affects the periosteum, but the connective tissue and bone as well and, as stated before, resorption takes place in the presence of increased blood supply. Resorption now takes place as a forerunner of the osteogenetic process. Leriche and Policard speak of bone resorption under this condition as a "calcific surcharge" in which resorbing bone frees calcareous elements which are necessary for ossification. This stage in bone repair is designated as rarefying osteitis. This disappearance of bone tissue always precedes the formation of new bone and forms the basis for ossification. Trabeculae of new bone soon appear close to the ends in the connective tissue and grow towards each other until they unite. This partly organized mass of osseous granulation tissue of the consistency of jelly is most abundant beneath the periosteum and extends between the ends of the fragments. This is the provisional callus and should occur in about two weeks after the formation of the clot. Therefore it is apparent that for the best results the ends of the bone should be brought into apposition before resorption takes place.

Lime salts are deposited at different points within this provisional callus so that a ferrule is formed about the fragmented ends and usually extends along the periosteum as far as it was disturbed. Practically the same process takes place within the cancellous bone forming the "definitive internal callus" which soon fuses and becomes porous bone. Both the provisional callus and the internal callus contain very little lime salt and except with a soft tissue technique are transparent to the roentgen ray and even then are exceedingly difficult to demonstrate. Roentgen examination will show the position of the fragments and may be misleading due to the widened area of bone resorption and even later often does not show that the bones have united. The roentgenogram shows shadows which tell only part of the story since the amount of repair is always greater than shown. The rarefied area between the fragments may persist for many weeks and there may be an excessive rarefying osteitis with continued delay in the ossifying callus.

In compound fractures of the mandible where infection is present, suppuration results. This suppuration delays the formation of the provisional callus and union is by the internal callus, which is not so favorable. The suppuration also aids in bringing about sclerotic changes which mechanically obstruct repair and disturb the deposition of lime salts. The presence of infection apparently possesses some element of embryonic digestion and interferes with formation of regular smooth callus. Delayed union also results from faulty relation of the fragments to each other or to small detached fragments which later become foreign bodies and sequestrate.

Other conditions such as wasting diseases, tuberculosis, or syphilis may be present to prevent normal healing. In these cases the clot which occurs along each fragment remains separate and the ends of the bone rounded and enlarged, and a condition persists which is known as pseudo-arthrosis. The roentgen findings here are fairly distinct, showing an eburnated bone smooth and polished on the ends.

It has been necessary to bring out these foregoing facts and theories in order to

have a clear conception of mandibular fractures, their cause, frequency, incidence and methods of fixation; the process of repair and statistics showing the time period of fixation and ultimate end-results, in order to point out clearly some of the reasons why such cases are often the cause of malpractice suits.

First, as stated, surgical care of mandibular fractures is primarily the task for an oral surgeon, and when attempted by others not versed in the care of the mouth and teeth or the mechanics of mastication, the probability of obtaining a result which will be above criticism and will be satisfactory to the patient, is extremely slight. This is an observation based on contact with many patients who consult an oral surgeon after healing has taken place and the deformity or malocclusion has to be corrected. Many of these patients have not had the advantage of a roentgen examination. In a recently quoted case Turner vs Stoker (Texas 289 SWR 190) a judgment was awarded to the plaintiff on the contention that it was negligence on the part of the physician not to have used the roentgen ray in order to establish a correct diagnosis. That it was commonly used by physicians in similar cases in the same community is assumed, as such a line of reasoning is used as the basis for many other decisions rendered when it was necessary for the jury to decide whether or not there had been negligence.

As has been brought out, the entire mandible should be examined as more than one fracture may exist or the fracture may be complicated by a dislocation.

The resorption about the line of fracture and inability to demonstrate callus for a longer period in the jaw than in long bones, even with clinical evidence of healing, has been the basis for suits claiming non-union.

Mechanical contrivances are necessary to bring the parts into correct apposition and some pressure is exerted. And, as has been stated, bone resorption takes place in the presence of pressure and exists for a long period. This decrease in lime salts is much more easily demonstrated by the roentgen ray than any new poorly defined callus. Failure to recognize this fact is often the cause of misinterpretation of the films even though there may be clinical evidence of union. This fact alone, and the slow formation of definite callus following fractures of the mandible often leads to aggravating experiences. The same may happen in other fractures but is most common in the jaw. Three such cases have come to my attention within a short time. Suits have either been started or threatened claiming failure of union. These patients had been examined roentgenographically and reported as "no evidence of union." One, however, had been reported by the roentgenologist as having good position and firm fibrous union but when the films would not be delivered to him went directly to a lay laboratory and received both films and the report stating that no union was present. A clinical examination showed good union at the time of the roentgen examination and subsequent roentgenograms showed an ideal result.

CONCLUSIONS

1. Reduction of fractures of the mandible require special treatment.

2. Roentgen examination should include the entire jaw.

3. Resorption about the fracture shows for a long period and is often interpreted as non-union.

4. Failure to demonstrate union by the roentgen ray does not mean that there is no union present.

5. In uncomplicated cases sufficient time should elapse before a definite statement is made that no union exists between the fragments.

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DISCUSSION

Dr. R. H. Ivy, Philadelphia. A free discussion of the subject of fractures of the mandible by members of this Society is most appropriate, because there is no doubt that in the past it has not received the attention it deserves. I wish to congratulate Dr. Donaldson upon his clear presentation which shows his appreciation of its importance to members of your specialty. I am unable to take exception to anything he has said, so in discussion will try to emphasize a few of the points which he has mentioned. In my opinion, the true significance of the roentgen examination in fracture of the mandible is not always correctly appreciated by the roentgenologist. Roentgen reports based on a misconception may lead to serious medicolegal complications. Too much significance should not be placed on roentgen reports alone as to the position of fragments before reduction, or as a check-up on position after reduction.

For example, we may have a roentgen report of a fracture of the body of the mandible, stating that the fragments are in good position. If this report were relied on solely, one would be tempted to let the case alone, when clinical examination might show a marked disturbance of the occlusion of the teeth. In other words, in fracture of the mandible we require a more exact criterion of the correct alignment of fragments than is possible by means of the roentgen film. That criterion is the occlusion of the teeth. On the other hand, after reduction and fixation of a fracture in the region of the angle or ascending ramus behind the line of the teeth, as long as the occlusion of the teeth is corrected, no attention need be paid to malposition of the posterior fragment as shown by the roentgen ray. Yet the effect of such a roentgen report on a jury might work harm to a surgeon who has obtained an excellent clinical result in the case of a dissatisfied patient.

Unfamiliarity with the best technique for examination of the jaws on the part of many otherwise excellent roentgenologists is a frequent cause of error. In a case recently seen of comminuted fracture at the symphysis of the mandible, where the two sides were freely movable on each other, the roentgenologist reported no fracture of the mandible, because he resorted to only the usual oblique and posteroanterior views. The symphysis was entirely masked by the vertebrae. The only adequate way to show a fracture through the symphysis, as pointed out by Dr. Donaldson, is by means of the occlusal film placed in the mouth between the maxillary and mandibular teeth, and the rays directed from beneath the chin. It is a surprise to me how few general roentgenologists appear to be familiar with this technique.

In addition to the positions mentioned by Dr. Donaldson for showing fractures of the mandible, a great deal of detailed information as to the teeth near the fracture is afforded by the ordinary dental film.

The importance of the roentgen examination to the clinician in fracture of the mandible lies not so much in determination of the presence of the fracture, or even in showing the position

of the fragments in the ordinary fracture of the body of the bone, but in showing the amount of comminution, if any, and the relation of the fracture to the roots of the teeth. The latter is the most important, because this often cannot be determined in any other way until infection sets in.

During the course of treatment, the roentgen examination is also useful, not so much as a check-up on position of fragments, but to show secondary involvement of tooth roots and sequestrum formation. I can indorse Dr. Donaldson's statement that the roentgen ray is not to be trusted early as a criterion of union of the fracture. We have repeatedly seen firm clinical union precede by several weeks any definite roentgen evidence.

One of Dr. Donaldson's illustrations showed apparently double lines of fracture in the same region. This does not necessarily indicate a double fracture or a comminution, but may merely mean that the fracture line through the inner plate did not exactly overlap that through the outer plate.

It is gratifying to hear Dr. Donaldson recognize that the care of mandibular fractures is primarily the task of the specialist familiar with the mechanics of mastication. Failure to understand these principles on the part of the physician first caring for the fracture is a frequent cause of complications.

(Presented several slides.)

Dr. Wm. A. Evans, Detroit, Mich. Dr. Donaldson's peculiar fitness to instruct us on mandibular fractures is due to his close association with oral surgeons who have had an unusually large experience in such injuries. The University Hospital at Ann Arbor and the Receiving Hospital at Detroit are called upon to care for a very large number of injured jaws, the clinic at the latter institution being, it is said, the largest in the world. I have recently reviewed the records of the Receiving Hospital clinic in preparation for this discussion and find that I am in general accord with Dr. Donaldson's observations and conclusions.

Too much emphasis cannot be placed on his injunction to examine most fully all cases of serious head injury, in spite of lack of specific request from the attending surgeon, to determine the presence of mandibular fracture. The roentgenologist should have in mind the possibility of such injury and include this area in his study, since it has been observed that in the event such a fracture has been overlooked the roentgenologist and not the referring physician is held to be at fault.

The roentgenologist cannot be expected to be familiar with the mechanical details of treatment of mandibular fracture, but he must and should know the course of repair and of the possibility of complications which delay healing. There is danger in accepting without question that an apparently slow or delayed union is a normal physiological condition. While it is true that bone union may be retarded in uncomplicated healing, careful study should be made in such cases to rule out the presence of foreign body in the line of fracture, such as tooth or bone fragments, and in order to make sure that no low grade infection is present. Likewise the presence of signs of movement of the fragments incident to imperfect splinting should be ruled out. Characteristic changes can be detected in callus formation caused by slight movement of the fragments in any fracture, and such changes should be looked for as the progress of healing is observed.

Dr. Donaldson has properly called attention to the medicolegal aspects of delayed union of mandibular fractures, and the successful defense of such a case will depend upon the proof to the court that healing of fracture of the jaw is dissimilar to healing of fractures of the long bones. Anyone who is required to appear frequently in court realizes that roentgen records serve as a two-edged sword in that they may work to the advantage or disadvantage of the common claim. In cases of this nature one should insist that a suitable time elapse between the injury and the time of the hearing, to permit full healing to take place.

Dr. Henry K. Pancoast, Philadelphia. The medicolegal aspect of the subject has been discussed from the standpoint of the oral surgeon, and one of Dr. Ivy's slides, I think, would indicate that if that particular technique of examining a symphysis fracture by means of the interdental film were used universally, there might be some medicolegal troubles stirred up among the roentgenologists because of the danger of electric shock. As a member of the Safety Committee, I cannot do otherwise than offer certain objections to the technique which was suggested. If that technique is used, it is most important to remember that your voltage must be quite low. Otherwise, the patient is in danger of getting a shock, especially if there should be

some movement on his part or some unusual occurrence whereby the voltage would be raised higher than anticipated.

Dr. Donaldson has told me privately that he has another method of examining the symphysis fracture with the interdental film and I think it would be very well if he would tell us how he does it for our own protection.

Dr. George E. Pfahler, Philadelphia. Confirming what Dr. Pancoast has said, I think that the suggestion of carrying out the technique recommended by Dr. Ennis and used by most of us is probably easily met by using the safety dental unit, whereby one can place the cone directly under the jaw and hold it there with his own hand or have the patient hold it. In other words, it is a safety unit. Dr. Pancoast's objections were to open wires which we could see in the illustration used there. Those should never be used in that way, surely. That is a very wise caution.

Dr. Donaldson (closing). I may say that fractures of the jaw are much more common than usually supposed and that in relation to fractures of other bones of the body they rank nine to one, that is, considering both maxilla and mandible. Fractures of the mandible in relation to those of the maxilla can be shown by a survey we made of 152 cases—38 were of the maxilla only, 8 were of both maxilla and mandible and the remaining number were fractures of the mandible alone.

We use an angle board as Dr. Pancoast suggests. We have a board made similar to the old fashioned bootjacks. The patient is placed on his back and his head allowed to drop backward and downward through the notch at the end of the bootjack, the film is then placed in the mouth and the tube tilted so that projection is directed downward through the symphysis and parallel to the long axis of the lower incisors. The anterior portion of the mandible which is not shown to best advantage on the lateral views is demonstrated by this method.

SOME UNUSUAL PNEUMONIAS ASSOCIATED WITH THE ASPIRATION OF FATS AND OILS IN THE LUNGS*

By J. W. PIERSON, M.D.
BALTIMORE, MARYLAND

IN 1925 Laughlen[1] reported 4, and in 1927 Pinkerton[2] reported 6 cases in which they found large amounts of fatty material in the lungs. They were convinced, as a result of animal experimentation and pathological study, that the fatty material was deposited in the lungs by fats and oils introduced by way of the trachea. They had been preceded in their observations by other workers, who reported the results of intratracheal injections in animals of mineral and vegetable oils. Laughlen in his 4 cases considered that mineral oil was the offending substance, and he conducted experiments with rabbits, making use of that material. He was able to reproduce in the animals the pathological changes similar to those which he had found in the cases previously examined, which were as follows: the alveoli contained large quantities of oil, some of it free, but the major portion was found within large mononuclear cells; the usual epithelial lining of the alveoli was replaced by cuboidal epithelium, a condition which is not infrequent in atelectasis. Pinkerton, in describing the pathological changes which took place in his cases, recognized three stages of the disease. The first, which corresponded to Laughlen's findings; the second, which showed an interstitial fibrosis; the third, practically an end-result, which showed a firm nodular fibrosis of the lungs. He considered that the pathological picture depended upon the length of time the foreign material had been in the lungs.

This present communication was prompted by an experience with a number of cases, two of which have been proved.

CASE REPORTS

CASE 1. A boy, aged four months, was admitted to the hospital because he did not gain well and had a chronic cough. The family history was negative, except for the fact that the father developed pulmonary tuberculosis shortly after the patient was admitted to the hospital, and that both parents had positive Wassermann reactions at the time of the child's admission. The patient remained well up to the age of two months, when he developed some difficulty with feeding, and a cough. He often awoke with much mucus in his throat; for the relief of the cough he was given oil drops in his

FIG. 1. Case 1. Large irregular areas of consolidation were seen in each lung, particularly the right. The shadows in the left lung were due to the presence of lipoid material, fibrosis, and chronic pneumonia, while those in the right were due to the same causes, plus areas of fresh pneumonia. Variations in the extent of the pneumonic process caused corresponding variations in the roentgenologic picture. Therefore, no "typical picture" of this disease can be described.

* From the Department of Roentgenology of the Johns Hopkins Medical School, Baltimore, Md. Read at the Thirty-second Annual Meeting, American Roentgen Ray Society, Atlantic City, N. J., Sept. 22-25, 1931.

nose over a period of weeks. He continued to go down hill, and was brought to the hospital on November 8, 1929.

Physical Examination. The physical examination revealed an under-nourished under-developed white boy of four months, breathing rapidly and coughing occasionally. He had a mild pharyngitis, slight clubbing of the fingers and a palpable spleen. There was dullness to percussion over the upper half of the right lung and some impairment to the percussion note in the left interscapular region; a few scattered moist râles were heard in the same location.

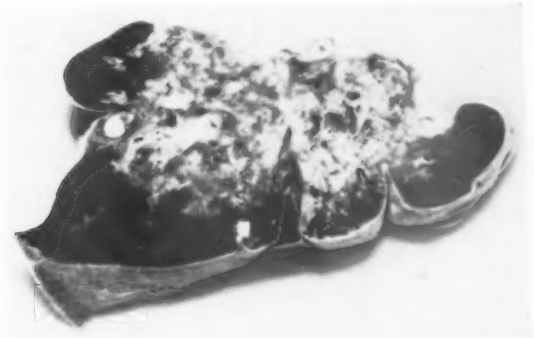

Fig. 2. Case 1. A large portion of the right lung was occupied by extensive fibrosis and lipoid material. Areas of pneumonic consolidation were seen in various portions of the lungs. The pathological findings in the left lung corresponded very accurately to the shadows seen in the roentgenogram.

Laboratory Data. The Wassermann reaction was negative; all the tests and cultures for tuberculosis and fungi were negative.

Course in Hospital. The course in the hospital was one of very slow improvement over a period of ten months. The signs in the chest remained practically the same, with dullness over both lungs posteriorly and a few scattered moist râles; thus, instead of the process clearing up, the child grew away from it. Two weeks before his death, November 22, 1930, he developed acute otitis media, followed by mastoiditis and streptococcus meningitis. There was no change in the pulmonary condition during his final illness.

It is interesting that during his first few weeks in the hospital he received both cod-liver oil and mineral oil by mouth, often coughing and gagging during its administration.

Many roentgen examinations were made over a period of a year, and the following observations have been selected as representative of the changes which took place in the appearance of the lungs.

November 23, 1929—"The entire right lung field is occupied by a very dense shadow, except for a small area at the costophrenic sulcus. The upper portion of the shadow presents an homogeneous appearance, such as is usually seen in lobar pneumonia. The lower portion of the shadow is very irregular in density and suggests either a resolving or a tuberculous pneumonia. The shadow in the left lung field is very interesting, in that its outer margin is rather sharply defined, running parallel to the axillary line and lying about 2 cm. from it. The shadow occupies both the upper and lower lobes. An attempt to interpret this roentgenologic picture would suggest a diagnosis of tuberculosis with a superimposed lobar pneumonia, though the shadow in the left lung would be rather difficult to explain on the basis of tuberculosis."

It was an interesting feature that the changes in the lungs as shown upon the roentgenogram were much more extensive than those elicited by physical examination.

July 7, 1930—"The shadows in the lungs are gradually becoming more irregular in density and less clearly defined. The area of consolidation in the right upper lobe has largely disappeared. The gradual changes in the lung picture would tend to confirm the diagnosis of a tuberculous infection."

November 10, 1930—"The shadows in the lungs are very hazy and indistinct, and a band of thickened interlobar pleura is seen on the right side; numerous nodules are seen lying at the roots of the lungs."

"A study of the series of films would seem to render most logical a diagnosis of tuberculosis."

Pathological Report. Gross specimen—"The heart appears normal. The right lung shows no extensive consolidation; there is some consolidation about the hilus of the right lung. On passing to the left lung, there is found to be very extensive consolidation occupying all the more central part of the lung, leaving some parts uninvaded at the apex and base and outer surface. There is a very peculiar consolidation with a good deal of scar tissue extending out from and around the bronchi and blood vessels, ending rather sharply against normal looking tissue; but more striking than the scarring is the mottling with yellow tissue, which lies everywhere between the gray tissues. There are even tubercle-like nodules 2 or 3 mm. in di-

Fig. 3. Case II. The shadows in the lungs were caused by the pathological processes which appeared in the third stage of the disease, namely chronic fibrosis, chronic pneumonia, and the presence of large quantities of lipoid material. The roentgenologic picture remained more or less constant in this case, as there was very little evidence of areas of fresh pneumonia.

ameter. All this tissue is found to contain a fatty material which gives the reaction of petroleum oil."

Case II. A girl, aged four months, was admitted to the hospital because of a cough, vomiting, and failure to gain. The family history was negative, save that the grandmother had latent tuberculosis, but had no close contact with the child. The child was premature, weighing 4 pounds 14 ounces at birth. There was rather severe jaundice up to three weeks after birth. For the first six weeks of her life she gained steadily and appeared normal. About this time she began vomiting and slowly lost weight. There was also a severe cough which may have played some part in the vomiting. Many adjustments of the formula had no beneficial effects on the illness. The patient was admitted to the hospital because of the above symptoms and her contact with tuberculosis. The child was given mineral oil from the age of two weeks to the time of admission, almost every day, for the relief of constipation.

Physical Examination. On admission she was an under-nourished, poorly developed white child of four months, weighing 7 1/4 pounds. The respirations were rapid, and she occasionally had a hacking cough. There was impairment of resonance over the upper half of both lungs posteriorly, with diminution in the intensity of the breath sounds in the same region. The child vomited whenever given water or food, and peristaltic waves could be seen through the thin abdominal wall; the liver and spleen were both palpable, as was the left kidney.

Laboratory Data. The Wassermann and tuberculin tests were negative. There was deficient kidney function.

Course in Hospital. The course in the hospital was a steadily down hill one with increasing urinary infection, fever, and vomiting. After four weeks in the hospital the patient died on December 13, 1930. Up to the time of her death there was little change in the pulmonary condition, the dullness to percussion, the decrease in breath sounds, and the occasional moist râles persisting.

The *roentgen findings* in this case were as follows: "A large portion of each lung field is occupied by a rather hazy indefinite shadow extending from apex to base and lying adjacent to the heart and mediastinum; the external borders of the shadow are rather sharply defined. The location and the density of the shadows in the lungs would suggest tuberculous consolidations, but no enlarged glands or areas of calcification are noted, which fact would contraindicate that diagnosis."

Fig. 4. Case II. Widespread deposition of lipoid material with associated pneumonia and fibrosis was seen in each lung. The bulk of the lipoid material was found in the posterior portions of the lungs.

Experience with the previous case led to a diagnosis of fat or oil in the lungs.

Pathological Report. Gross specimen—"The lungs are the seat of a chronic lipoid-cell pneumonia with a superimposed lobar pneumonia, so that there is a mixture of the chronic changes with fresh inflammation. In the area of the lipoid pneumonia the alveoli are very much distorted and now form widened irregular spaces which are lined by high, almost cuboidal epithelium, containing globules of fat. In addition, many of these alveoli are partly filled with polymorphonuclear leucocytes. There is some scarring between the dilated alveoli. There are often dense-looking thick bands which seem to contain some scar tissue, and in which are found many mononuclear cells and phagocytes filled with fat. Some bronchi contain purulent exudate; others are occluded with fat globules and phagocytes loaded with fat. The blood vessels often are filled with bacteria, and some of the capillaries are partly occluded with hyaline-staining material which looks like fibrin. There is nothing like tubercle formation anywhere in the lungs."

Microscopic note—"Both lungs show large areas in which the alveolar spaces are filled with a granular pink material suggesting aspiration. Some fibrin is present, and there are a few inflammatory cells. Many large globules of fat are seen, which are readily brought out with a fat stain. The greater part of this fat is entirely free of fat-holding cells."

SUMMARY OF CASES REPORTED

These children were ill for a long time, and finally died of an extrapulmonary infection. During their illness the pulmonary signs and symptoms did not dominate the clinical picture, and all tests for tuberculosis were consistently negative. Each child was given oil over a considerable period of time. The roentgenologic findings presented a very accurate picture of the gross pathological changes in the lungs, and they indicated much more extensive pulmonary involvement than was brought out by the clinical examination. The pathological reports revealed that there were large quantities of fatty material in the lungs, and that there was evidence of chronic pneumonia and fibrosis, which changes corresponded to those reported in similar cases by previous workers.

MODE OF ENTRY INTO THE LUNGS

The frequent use of oils in pediatric practice and the frequent vomiting of food by the children offer potential sources of the fats in the lungs. When children regurgitate their food they ofttimes aspirate some of the vomited material into the lungs, so that it is easy to conceive that the fats from the milk may be deposited in the alveoli. MacCallum[3] states that he has observed many cases of a similar nature. Laughlen has shown by experiments on rabbits that oil introduced into the nasopharynx or placed on the tongue has no difficulty in finding its way into the alveoli of the lungs. Therefore, it would seem to be consistent to assume that oil administered to infants in the same fashion would reach a similar destination. There are other sources of fatty materials in the lungs than those just described. Fats have been found in the lungs as the result of disturbances of the metabolism due to pancreatic deficiency, but never in such quantities as herein reported; they have been found in considerable quantities in the lungs of normal dogs, but the droplets are always extracellular, and no lung reaction is reported; they may originate in the lungs in association with chronic pneumonia and tuberculosis, but again the quantities are meager and the droplets small. Pinkerton, by careful studies of his cases, showed by means of staining reactions, solubility and refraction of the fats in the lungs, that they corresponded to the material administered to the patient, and that they did not correspond to the fats usually found in the lungs in either normal or pathological conditions.

PATHOLOGY

When the oil reaches the alveoli of the lungs it causes an outpouring of many large mononuclear cells, which immediately encircle the oil droplets. These large cells are endothelial in origin; they probably arise from the walls of the capillaries

of the alveoli, and they correspond to the dust cells of pneumoconiosis. The epithelium of the alveoli changes from its normal appearance and becomes more cuboidal. The large mononuclear cells, by their phagocytic action, pick up the oil and pass from the alveoli into the lymphatics, which soon become engorged with them. Some of the cells rupture, allowing the oil to become free in the lymphatics, whereupon the large cells become massed around the oil, thus causing the formation of nodules and the beginning of fibrosis. The drainage of the lungs is obstructed, the condition becomes aggravated, and many of the alveoli are obliterated. The large oil-laden cells, in their passage along the lymphatics, cause the formation of many small lymph nodules. Thus a chronic consolidation associated with fibrosis and atelectasis is brought about.

All of the above pathological changes are registered upon the roentgenogram, but our experience is too meager to attempt to establish any criteria for their accurate recognition. The picture produced by the fatty material in the lungs more nearly resembles that of tuberculosis than it does any other with which we are familiar, but continued negative laboratory findings will rule out that disease. The areas of consolidation of lipoid pneumonia are more extensive and more clearly defined than those seen in bronchopneumonia, and their borders are not limited by the ordinary anatomical subdivisions of the lungs, as is usually seen in lobar pneumonia. The roentgenologic picture varies from time to time, according to the different phases of the disease. At times large areas of consolidation are seen, while at others the processes of fibrosis seem to predominate. It is this great variation in the roentgenologic picture that renders the interpretation so difficult. Continued vigilance should be employed in order to promote recognition of this condition.

CONCLUSIONS

Fats and oils often reach the alveoli of the lungs when they are administered to children either orally or through the nasopharynx.

They collect in large masses in the lungs and are associated with chronic pneumonias and fibrosis.

The widespread use of oils in pediatrics offers a large potential source for this condition.

The presence of fatty material in the lungs produces a very interesting roentgen picture, but no pathognomonic signs are offered.

This communication is presented with the hope that it may stimulate roentgenologists to make such observations as will aid in the diagnosis of this condition.

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DISCUSSION

Dr. Eugene P. Pendergrass, Philadelphia. My interest in this subject was first stimulated by the work of Pinkerton in 1927. At that time Dr. Bromer, as well as ourselves, was interested in the lung changes associated with rickets. I often wondered whether the lung densities might not have been due to cod-liver oil that found its way into the lung fields with subsequent development of a pneumonitis.

The references on the subject are few. In 1920 Guieysse-Pellissier reported the results of intratracheal injections of olive oil into the lungs of rabbits and dogs. He found the alveoli filled with large mononuclear cells which had engulfed the oil, also polymorphonuclears and eosinophils. Corper and Freed in 1922 found marked changes in the lungs from the injection of chaulmoogra oil, dependent upon chemical reaction of the oil. They found that olive oil and petrolatum would be retained in the al-

veoli for a long period of time and then produce a mild proliferative bronchopneumonia.

Laughlen in 1925 reported 4 cases similar to this. In 1927 and 1928, Pinkerton reported 6 cases, one of which had a pneumonia, the others an interstitial fibrosis which on gross examination was suggestive of tumor formation, like the so-called paraffinoma produced by the subcutaneous injection of oil. The oil causes a proliferation of the phagocytes.

The origin of the phagocyte is a moot point, but the majority of the investigators believe that the cells are endothelial in origin, similar to the dust cell. The cells engorge themselves with oil, some become giant cells. They then pass into the lymphatics and finally into the general circulation, via the tracheobronchial lymph nodes. If this plan is upset, serious changes occur from deposition of the fat in the interstitial tissues, with subsequent proliferation of endothelial cells and connective tissue. The resultant pathology resembles that of pneumoconiosis.

An acute infectious process is usually superimposed on the picture described above and is probably the immediate cause of death.

Dr. Pierson reports 2 additional cases. It should be noted that this lung condition occurs almost invariably in children and infants who are emaciated and weak, in whom the swallowing act is thereby disturbed and in whom it would be easy to explain the aspiration of oil into the lungs. We should, therefore, consider the possibility of chronic lipoid pneumonia in arriving at diagnoses of chronic lung infections, especially when the patient is a weak and malnourished child who has been receiving various oils as a part of its medical care.

Roentgenologists for years have used iodized oils extensively and apparently without any harmful results. Pinkerton in 1928 reviewed the literature on this subject and reported the results of his own experiments. His conclusions are abstracted as follows:

1. Animal, mineral and vegetable oils injected intratracheally disappear slowly from the lung.

2. In the absence of infection, simple neutral vegetable oils do not produce any reaction. Their removal from the lung seems to be by expectoration.

3. Animal oils, including milk fat, cod-liver oil, etc., cause marked fibrosis and giant cell formation in a few days.

4. Mineral oil is quickly emulsified, taken up by phagocytic cells and lung consolidation is produced.

5. Free fatty acids of certain animals produce caseation necrosis in the lung tissue.

6. Lack of reaction to vegetable oils appears to be due to the lack of enzymes capable of hydrolyzing the oils.

The above conclusions show conclusively why it is safe to use vegetable oils for lung mapping. The lung density after the use of iodized oil is probably due to drowned lung from blocking of the bronchus and bronchioles, rather than to a proliferative lung reaction.

Dr. Gabriel Tucker, Philadelphia. This subject is of great interest to us as bronchoscopists because almost universally, I think, oils are used as intrabronchial medication. We are all familiar with the experimental work that Dr. Pendergrass has quoted as to these oils, but still the oils are used. They are also used by otolaryngologists as medication in the larynx. Strange, we haven't seen any very serious results from these oils.

We use bronchoscopically under the direction of the roentgenologist iodized oils, as lipiodol, which are vegetable oils. We find that these oils are expelled from the normal lung quite quickly, from the diseased lung much more slowly. Sometimes it is a period of months before the residue of oil has disappeared from the lung on roentgen examination.

There is just one question that occurs to me after seeing these slides presented. Why was there not disease in both lungs if the aspiration of oil is responsible for the condition? The oil would be aspirated into the good lung much more quickly and more thoroughly than into the diseased lung. Is it not possible that this oil is just a secondary thing, that possibly in a diseased lung the oil cannot be expelled and it remains there? Of course, it may change the pathologic picture, probably it does, but why not the other lung also if it is a question of aspiration of oil? If you had a diseased lung there would be more oil aspirated into the good lung than the diseased lung, most likely. Why are not both lungs diseased if this condition is due entirely to the aspirated oil? I do believe that it is not wise to flood the lung with any sort of medication either aqueous or solutions in oil. I shall follow the developments from this important study very carefully.

Dr. Willis F. Manges, Philadelphia. I

must admit I don't know anything about the diseases under discussion. However, in the study of lung conditions one generally always has certain things in mind. I have done so much foreign body work and I have thought so much about interference with drainage of the bronchi that I am almost apt to start to view practically all lung lesions from the viewpoint of mechanics. I start to think about bronchial obstruction almost as quickly as I stop to think about any sort of disease. It is remarkable how many causes of bronchial obstruction there are. I don't know from experimental study or from experience with this disease whether I am right or not, but I suspect that those cases that have had pneumonia following the inhalation of oil have had pneumonia because beyond the oil disease-producing bacteria have been trapped; there has been an interference with drainage, probably an irritation or an inflammation set up by a particular kind of oil, and it flares up in one instance and becomes an acute process called pneumonia; in another it remains more or less a chronic inflammatory process and we may or may not give it a name, and so it goes on. Oil isn't an easy thing to move along; it is slippery. It stays where you put it until you actually turn something upside down and let it run out. The cilia of the bronchi do not bring the oil out. Oil comes out either because it is forced out by a violent blast of air or because the patient assumes a posture whereby the oil goes down hill. I believe that in these cases where oil has been used for medication there has possibly been infection of the upper respiratory tract and that infection, if not already in the lung, has gone down with the oil, and in that way caused trouble. Iodized oil, I think, is a different matter. In the first place, it has perhaps certain antiseptic qualities in itself. It has a weight, particularly, to make it go to the most dependent portion of the air passage, whereas the globule of oil unweighted with iodine goes to a narrow lumen and there it stops. It is mechanically stopped in the form of a globule or because there is a mass of mucus beyond it, and it slowly gets into distant portions and as it goes, there is infection as a result of poor drainage.

I believe there is a definite element of that. I am sorry Dr. Pierson didn't bring out in his paper the information as to whether the deposited oil was in the front part of the lung or whether perchance it was in the posterior part of the lung where it should be, if I am right in assuming that it is a matter of going to a dependent portion and not getting out, because it doesn't run up hill; the cilia don't affect it and perhaps there isn't enough of the coughing effort to bring it up.

Dr. Henry K. Pancoast, Philadelphia. Dr. Tucker raised a question as to why one lung was more affected than the other. I think in Dr. Pierson's cases, the right lung was the worse of the two. That is about what one would expect from our knowledge of the inhalation of dust. The right lung is, with very few exceptions, the one which is first affected and the one which is the more affected of the two until it is impossible to distinguish any differences between the two. It is a question of mechanics which may be added to the mechanical features which Dr. Manges has already mentioned.

Iodized oil is used once or twice or very few times in a single individual. The administration of cod-liver oil and milk to children happens very frequently every day. If you used iodized oil every day in an individual, you might also get into the same difficulties that are produced by other fats given to infants. Moreover, iodized oil is almost always used in older individuals who will cough up a large part of it. It is a question with me as to whether the ciliated epithelium does not have something to do with the elimination of oil in the smaller bronchioles. Certainly, if it does and the oil gets beyond the ciliated epithelium, it has no way of getting out. It then must be phagocyted to be removed, and some of it must stay in a long time. The oil which goes into normal bronchi and bronchioles in the administration of lipiodol does not, as a rule, get down this low.

Dr. A. Howard Pirie, Montreal, Canada. In connection with oil getting into the lungs, let me describe a little experiment which any of you can repeat. One of our staff, Dr. Bethune came into the hospital and took a bed for the the night in order to get a roentgenogram made the next morning. Before he went to bed, he passed a catheter up his nose till the free end of it was in his pharynx. In the front of the catheter he had 5 c.c. of lipiodol with a catch on the tube to keep it from escaping. He drank two bottles of Moulson's ale and went to sleep lying on his back. The house surgeon slowly released the catch on the tube, and drop by drop the lipiodol went into his pharynx, as he lay on his back. He got all the lipiodol while

sound asleep. The next morning, without being moved, he was brought to the roentgen department and we took a picture and found the whole of the lipiodol in his right lung.

Dr. Pierson (closing). I am glad that Dr. Manges brought up that point about the location of the oil in the lungs, as I did not have time in the presentation of the paper to give a full pathological picture. As the children lay on their backs, the bulk of the oil ran to the dependent posterior portion of the lungs.

I believe that both Dr. Pancoast and Dr. Manges have answered Dr. Tucker's question. Laughlen brings out the point in his experiments of the possibility of trapping infection in the lungs or carrying infection into the lungs by the passage of oil down through the respiratory tract.

OSTEOPOIKILOSIS

(DISSEMINATED CONDENSING OSTEOPATHY)

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OSTEOPOIKILOSIS or osteopathia condensans disseminata is a condition which is relatively rare in the medical literature. It is characterized by a disseminated condensation of the bones of the skeleton without clinical symptoms. All of the bones have been shown to be involved except the bones of the skull. The multiple areas of increased density vary in size from 2 mm. to 2 cm. in diameter and are found in the spongiosa of the epiphyses and the metaphyses of the bones. They are not found in the mid-portion of the diaphyses of the long bones. The condition has been observed in both males and females and as it occurs without symptoms, it is found by accident during a roentgen examination for some other condition.

Albers-Schönberg[1] first reported a case in 1915, calling it a rare structural anomaly of the skeleton. His patient was a young man twenty-two years of age who was examined because of pain in the shoulder. Ledoux-Lebard, Chabaneix, and Dessane[7] reported a case the next year and called it "ostéopoecilie" because of the spotted appearance of the bones. In 1918, Moreau[8] reported in detail a case of generalized condensing osteitis (ostéopoecilie) in a man thirty-one years of age suffering from tuberculosis of the spine. Newcomet[9] reported a case in 1929 which had been observed

TABLE I

ALL CASES OF OSTEOPOIKILOSIS FOUND IN THE LITERATURE

Author	Year	No. of cases	Sex	Age	Hereditary or Familial	Anatomical Distribution of Lesions
Albers-Schönberg	1915	1	M	22	No	All bones except skull, spine, scapula and patella.
Ledoux-Lebard, Chabaneix and Dessane	1916	1	M	28	No	All bones except skull, spine and ribs.
Moreau	1918	1	M	31	No	All bones except skull, spine and ribs.
Watchel	1921	1	M	23	No	All bones except skull, spine, clavicle and scapula.
Richarz	1922	1	F	31	No	All bones except skull, spine, scapula and patella.
Schéle	1922	1	M	34	No	All bones except skull.
Voorhoeve	1924	2	M	14	No	All bones except skull.
			F	10	No	All bones except skull.
Steenhuis	1926	1	F	13	No	Involved bones not individually mentioned.
Amundsen	1929	1	F	30	No	All bones except skull, spine, clavicle and ribs.
Gluch	1929	1	F	19	No	All bones except skull.
Newcomet	1929	1	M	50	No	All bones except skull.
Kahlstorf	1930	1	M	26	No	All bones except skull, spine and ribs.
Awalischwili	1930	1	M	24	No	Involved pelvis and lower extremities.
König	1930	1	Not given		No	All bones except skull.
Schmorl	1931	1	M	18	No	All bones except skull, clavicle and spine.
Reiser	1931	1	F	54	No	Involved extremities only.
Our cases	1931	2	M	21	Yes	All bones except skull and ribs.
			M	52	Yes	All bones except skull and ribs.

Total Number of Cases 19

over a period of four years and during that time there had been no change in the character of the bone involvement.

In a search of the literature, we have been able to find 17 cases of osteopoikilosis which are shown in Table 1 (including the 2 cases reported here, making a total of 19 cases).

The etiology is unknown but it is evident that there are more or less uniform disturbances in the proliferation and ossification of bone-forming cartilage during the period of development. Voorhoeve,[15] who reported two cases in 1924 and made an extensive study of this condition, stated that he believed the anomaly to be hereditary and that it should be placed in the group of dyschondroplasias.

It was hoped that a histological study of the condition would throw some light on the nature and cause of the changes in the bone structure, and Schéle[12] stated that "a definite explanation is scarcely to be expected until the pathologist-histologist has been given the opportunity of expressing his opinion."

Schmorl[13] in 1931 reported a case of osteopoikilosis in a boy eighteen years of age who had suffered from multiple osteomyelitis and had died from severe secondary anemia and amyloidosis. Careful autopsy study was made and the report given by Schmorl is summarized as follows:

> Serial microscopic examination of the spotted areas revealed that the increased density was the result of numerous bone trabeculae of various thicknesses arranged rather regularly, the bone resembling the structure of the spongiosa and not of the cortex. The individual trabeculae were slightly thicker than those of the normal bone in that particular region. Because of this and their close arrangement, they gave the impression of a compact bone. The merging into the surrounding structures was gradual, the trabeculae disappearing among those of the normal spongiosa. The thicker trabeculae consisted of lamellous bone arranged mostly parallelly, but in a few instances also concentrically around blood vessels, however without leading to the picture of typical osteoma.

No deductions can be made from the above microscopic findings concerning the genesis of the disease. An endochondral origin can be eliminated on the basis that the foci show no connection with the endochondral zone of growth. The most plausible theory is that of a

Fig. 1. Roentgenogram of right hand of son, Case 1.

congenital anlage. It may be of added interest that the spots within the osteoporotic ankylosed areas themselves showed signs of osteoporosis, indicating that they held no vita propria as is the case in some congenital malformations.

The reason for making further comment on this condition is our interest in the hereditary nature of its etiology. Awalischwili[3] reported that six brothers of his patient were examined and the condition had not been found. None of the authors have reported finding a case of osteopoikilosis in one parent and a child or in brothers and sisters of a family.

In our cases the disease was present in father and son and the disturbances observed were so uniform that the hereditary character of the lesion at once became apparent.

Fig. 2. Roentgenogram of feet of son, Case 1.

The following is a brief résumé of the history in the two cases:*

Case 1. H. C., white male, aged twenty-one, bookkeeper, was admitted to the Surgical Service of Harper Hospital, October 22, 1931, with a history of lower abdominal pain. During a previous roentgenologic examination elsewhere of the urinary tract, an unusual condition of the bones of the pelvis was observed and he was sent to the roentgen department for further study. The past history of this patient was entirely negative, since he had been in good health until a few weeks before admission.

Family history revealed both parents living and well. Two brothers and two sisters were living and well. One sister had an unusual deformity of the right side of the head which had been present from childhood.

Laboratory examination in the Hospital revealed nothing of importance. There was no anemia or leucocytosis and the urinary findings were negative. The blood calcium was 10.5 mg. and the inorganic phosphates 2.5 mg.

Roentgen Report. Examination of the patient's skull, dorsal and lumbar spine, pelvis and the extremities, including the hands and feet, reveals a rather unusual distribution of calcium deposit or increased bone density in the ends of the bones, especially in the humeral heads, the glenoid process of the scapulae, head, neck and intertrochanteric regions of the femora, in the ilia, both ischial and pubic bones, sacrum and spinous processes of the lumbar vertebrae, the lower ends of the tibiae, the os calces and

* These cases are reported through the kind permission of Drs. N. M. Allan and Wiliard D. Mayer.

Fig. 3. Roentgenogram of pelvis of son, Case 1.

Fig. 4. Roentgenogram of hand of father, Case 11. Compare with Figure 1.

bones of the feet, the lower ends of the radii and ulnae, all the bones of the wrists and most of the phalanges, to a greater or less extent. The bones of the skull, the ribs and the mid-portions of the shafts of the long bones were alone uninvolved (Figs. 1, 2 and 3).

Case II. M. C., white male, aged fifty-two, the father of Case 1, was examined. The past history in this case was also essentially negative.

Roentgen Report. Examination was made of the pelvis, both hands, right knee and right foot. Multiple small areas of increased density were present in the bones of the wrists and

Fig. 5. Roentgenogram of pelvis of father, Case II. Compare with Figure 3.

hands, the ilia, sacrum, ischii and pubic bones, the femur, tibia, fibula and all the bones of the foot (Figs. 4 and 5).

A brother of Case 1, C. C., aged twenty-five, was examined and normal structures of the bones of both wrists and hands, the pelvis, the right knee and the right foot were found.

A sister of Case 1, V. C., aged twenty-eight, was also examined. She was of average stature and highly intelligent. There were numerous freckles on the face and neck and there was prominence of the right frontal area of her skull with drooping of the right eyelid. The condition of the skull had been present as long as she could remember, but her mother believed it began at about the age of five. Past history was negative except that birth had been by forceps delivery, and her mother stated she believed the deformity of the skull due to this.

Fig. 6. Roentgenogram of skull of sister, V.C., of Case 1, in lateral view. Note the hypertrophy of both the inner and outer tables.

Roentgen Report. Examination of this patient's pelvis, knee joints and both hands reveals no disturbance in the bony structures. Examination of the skull stereoscopically in the right lateral projection and a single film in the posteroanterior projection reveals a marked hypertrophy of the inner and outer tables of the skull, which are completely fused. The process

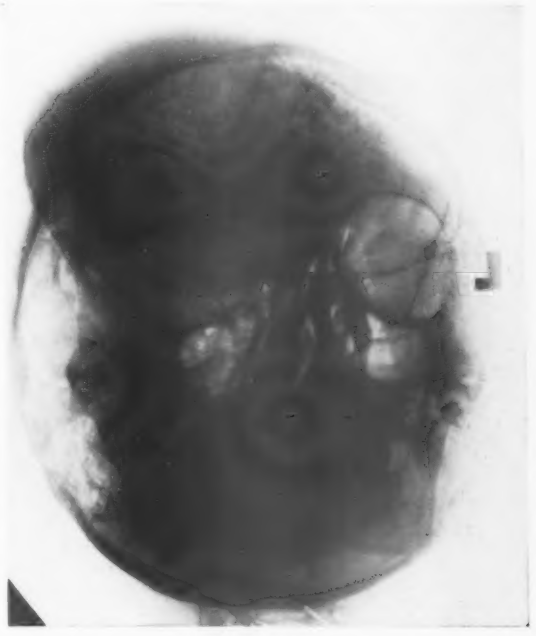

Fig. 7. Roentgenogram of skull of sister, V.C., of Case 1, in posteroanterior view. Note the distortion of the right orbit, antrum and ethmoid areas.

involves the skull on the right side from near the vertex posteriorly to the level of the supraorbital plates and the hypertrophy extends down into the sphenoidal sinus region. The sphenoidal sinus is not aerated. The sella turcica itself is of normal size. There is no evidence of a suprasellar cyst. The nature of the extensive hypertrophy which has involved the tables of the skull on the right side is not determined from the films. It has somewhat the characteristics of a leontiasis ossia (Figs. 6 and 7).

Comment. The outstanding feature in the two cases presented is the marked similarity of the disturbances in the skeletal system. The only difference is that the areas of condensation in the bones of the father were somewhat less dense than those in the bones of the son. The bone changes in the skull of the sister are shown only as a matter of interest, the exact nature and etiology being unknown.

CONCLUSIONS

Osteopoikilosis is probably not so rare as has been heretofore believed. Reports of this condition, however, have appeared rather infrequently in the medical literature and we have attempted to tabulate all the authentic cases. The similarity of the skeletal disturbances in the two cases, father and son, in our estimation forms most conclusive proof that the condition is of a hereditary nature, as was suggested by Voorhoeve.

In Schmorl's case which was studied at autopsy no mention was made of any abnormality in the parathyroid glands. It is of interest to speculate that osteopoikilosis may be associated with parathyroid disturbance. It is hoped that if further occasion permits of study of this condition at autopsy, the parathyroids will be investigated.

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MENSURATION OF THE HEART AND CHEST IN THE LEFT POSTEROANTERIOR OBLIQUE POSITION A COMPARATIVE STUDY

III. CORRELATIVE MEASUREMENTS OF THE AORTIC ARCH AND THE THORAX*

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ELABORATE studies of the thoracic aorta have been made, employing roentgenoscopic and roentgenographic methods. Both the right anterior oblique and left anterior oblique positions have been used, each finding staunch adherents. Conclusions drawn from much of this work have been worthless, the method being based on false premises relating to the anatomy of the region and the interpretation of roentgenologic shadows cast by these anatomical parts. The value of the methods used heretofore and the validity of the claims used in support of the various methods will not be discussed at this time. For the purpose of the present paper, it is sufficient to state that the measurements made heretofore have not attempted correlations with any diameter of the thorax; they have always been of a simple character relating to some portion of the aorta, such as the transverse diameter of the aorta in centimeters or inches. These measurements, naturally, vary according to age, weight, etc., and mean little because no standard of normal variations has been accepted up to the present time which is sufficiently reliable to permit the drawing of accurate conclusions.

I have approached the problem from a somewhat different angle, and have sought to correlate the measurements of the arch with certain readily determined chest measurements. This permits direct comparison of the measurements of the arch with the chest, and if the method is successful it eliminates the necessity of considering numerous variables.

The proper test for such a method lies in an analysis of a series of cases in which the pathology is known. Such a series (75 cases) has recently been analyzed from the standpoint of cardiac enlargement, and we used this same series in an attempt to establish correlations between dimensions of the aortic arch and thorax. The success of such a method in this series of cases is readily determined, because the cardiac pathology of the group is quite well established. No case of an abnormal aorta was included in this group, unless autopsy data were available and the normal series consisted either of autopsied cases or cases in which there was no clinical evidence of vascular disease.

The aorta under pathological conditions undergoes at least four types of structural change which might be recognized by roentgenologic means. Two of these relate to the wall of this vessel: (1) the presence of calcium plaques within the wall, indicative of arteriosclerosis; (2) the presence of a filling defect at the descending limb of the arch in cases of coarctation. The other two relate to variations in the lumen of the vessel: (3) evidence of local dilatation, as in aneurysm; (4) diffuse stretching of the aorta as the result of its loss of elasticity which is seen as a predominant effect of arteriosclerosis.

The first of these is obviously not susceptible to measurement. It can often be recognized on the plain chest film at the aortic knob. It is usually best recorded by means of a Potter-Bucky technique, which requires a short target-film distance. The defect produced by coarctation has been discussed elsewhere.

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Local dilatation which results chiefly from the loss of the elasticity of elastic and muscular fibers locally in the wall of the aorta, thereby permitting an increase in the caliber of a restricted portion of the vessel, is best measured by determining the transverse diameter of the aorta at the affected level in the left anterior oblique position. Correlations with this measurement were abandoned because of the difficulty which is experienced in delineating the inferior or concave aspect of the aortic arch and similar portions of ascending and descending aorta in many cases. These measurements have been studied in the past by numerous individuals, and elaborated more fully recently by O'Kane, Andrew, and Warren,[7] Hampton and Jones,[5] Hampton, Bland, and Sprague,[6] and Dann.[2,3] This measurement did not appear to be one which could be profitably correlated with any diameter of the thorax.

The effects produced by a diffuse stretching of the aorta, on the other hand, were readily detected by comparative mensuration of the aorta and thorax. This stretching, which affects the longitudinal axis of the aorta predominantly, results in the following changes which can be identified and measured: (*a*) Increase in the width of the swing of the aortic arch, which is recognized on the film as a spreading apart of the limbs of the aortic arch. This effect can be measured by determining the cord subtended by the arc produced by the arch of the aorta in the left anterior oblique position. (*b*) Increase in the height of the swing of the aortic arch, which is the result of the elongation of the aorta. It can be measured by determining the height to which the arch ascends above the cardiac level within the thorax. (*c*) Tortuosity, which results in the aorta in assuming a sinuous course within the thorax, is practically never present alone. It is associated with changes in the height and width of the swing of the aortic arch. Tortuosity can be identified by direct inspection of both the posteroanterior and oblique films of the chest.

The present study, therefore, undertakes to establish (1) the normal swing of the aortic arch within the thorax in the left anterior oblique chest film; (2) variations in the width and height of this swing under pathological conditions.

METHOD

The left anterior oblique chest film was obtained at the end of a moderate inspiration at an angle of approximately 45°. At this angle a cross section of human body taken at the level of the great vessels (Fig. 1) shows the projected distance between

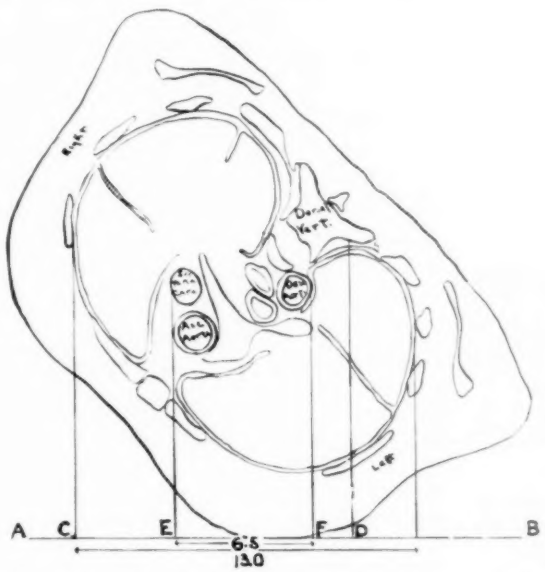


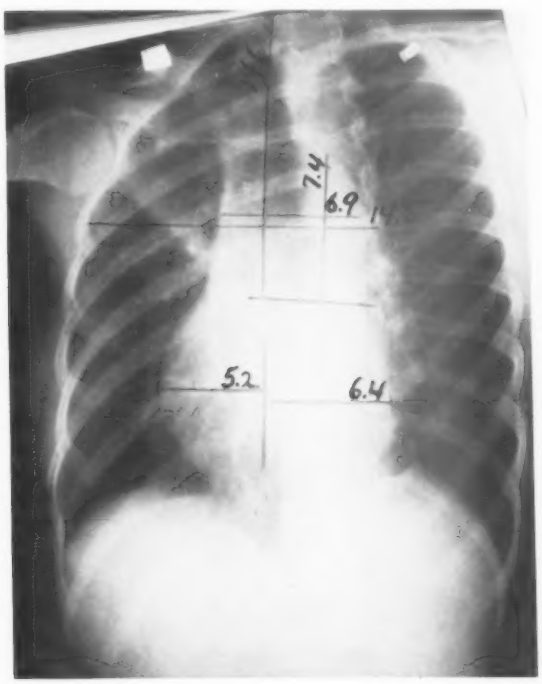
Fig. 1. Cross section of chest at level of great vessels, rotated 45° to base line *AB*. Note that the projected distance between the ascending and descending aorta (6.5 cm.) is one-half the projected distance between the right anterior chest wall and the left costovertebral articulations (13.0 cm). (Adapted from Eycleshymer and Schoemaker.)

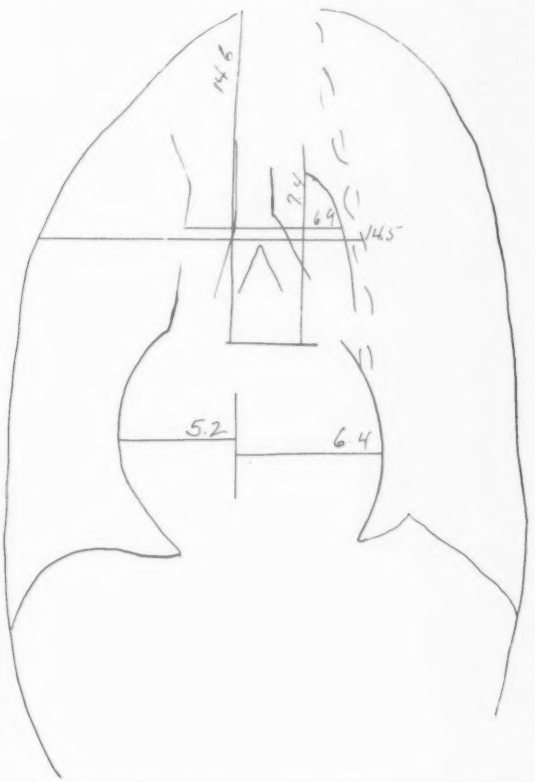
the ascending and descending aorta (6.5 cm.) to be one-half the projected distance between the right anterior chest wall and the left costovertebral articulations (13.0 cm.) at this same level. This information furnished us with a valuable clue for starting our work on correlation.

The aortic arch of the left oblique film was measured in the following manner: A line is drawn transversely from the ascending limb of the arch to the corresponding point on the descending limb at this level.

The measurement represents the outside dimensions of the arch as shown in Figures 2 and 3, illustrating the tracing of a left oblique film of a youthful individual, who at autopsy showed a normal aorta. The width across the aortic arch (outside dimensions between two limbs of the arch) measures 6.9 cm., which is approximately one-half 14.5 cm., the measurement between the right anterior chest wall and the left costovertebral articulations at this same level. It will be noted that the chest measurement is taken in exactly the same fashion as for use with cardiac measurements, except that it is taken at the level of the arch rather than at the cardiac level. The chest measurement is divided by the arch measurement to obtain a ratio called the transverse arch-chest index. This, in the present case, becomes 2.1.

In comparing the normal group with cases which presented arteriosclerosis, luetic aortitis, aneurysm and coarctation at autopsy, it was found that this index divided the normal group from the pathological group quite sharply. The normal group showed an index which was usually 2.0 or above. There were only two exceptions to this rule, and in these two cases the index was 1.9. The pathological group practically invariably showed an index below 2.0 (one exception only, in which emphysema was found at autopsy and the diameters of the chest may have been modified by this pathology).





Figs. 2 and 3. This film and tracing were secured from a youthful individual of twenty years, who gave no history relating to pathology in the aorta and whose arch was found to be normal at autopsy. The illustrations represent the course of a normal aortic arch. The cord diameter of the arch measures 6.9 cm., while the chest diameter is 14.5 cm., producing a normal transverse arch index of 2.1. The height of the arch (7.4 cm.) is practically one-half the vertical diameter of the chest (14.6 cm.), resulting in a normal vertical index of 2.0. The height-width index is likewise normal ($7.4 \div 6.9 = 1.1$).

Death occurred as a result of a subacute bacterial endocarditis, with septic emboli to the lungs and spleen with infarct formation, an acute embolic nephritis, and miliary abscesses in the myocardium and brain. There was also evidence of a healed rheumatic endocarditis involving the mitral valve and left auricle.

TABLE I

THE NORMAL AORTA

Variations in Indices Relating to Width and Height of Swing of Aortic Arch with Blood Pressure Determinations.

Case	Age	Index of Rotation	Arch Swing	Diam. (T) Chest	Trans. Index	Arch Height	Diam.(V) Chest	Vertical Index	Sum of Indices	Col. 7 / Col. 4	B.P.	Pathological Findings
S.M.	15	2.0	6.8	15.9	2.3	7.0	14.0	2.0	4.3	1.00	110/75	Normal
B.D.	20	1.5	6.9	14.5	2.1	7.4	14.6	2.0	4.1	1.10	116/70	Normal
J.S.	41	2.2	9.6	19.4	2.0	7.3	15.2	2.1	4.1	0.76	108/75	Normal
S.B.	7	2.0	6.3	13.0	2.1	4.5	8.5	1.9	4.0	0.71	110/70	Normal
L.J.	4	2.2	5.4	12.0	2.2	4.1	7.8	1.9	4.1	0.76	90/55	Normal
H.R.	11	2.4	7.0	15.3	2.2	7.0	12.5	1.8	4.0	1.00	118/72	Negative except for slight subintimal fat
J.H.	45	1.8	8.6	20.0	2.1	8.3	17.2	2.1	4.2	0.96	104/70	Questionable early luetic changes
E.R.	37	2.1	7.5	16.0	2.1	8.0	16.0	2.0	4.1	1.07	not stated	Normal
												Clinical Findings
D.M.	25	2.2	6.6	16.2	2.5	7.8	15.8	2.0	4.5	1.20	128/76	Normal
N.S.	15	2.0	6.7	15.4	2.3	7.2	13.5	1.9	4.2	1.07	118/65	Normal
I.W.	19	1.9	8.6	16.6	1.9	8.6	15.0	1.8	3.7	1.00	130/78	Normal

TABLE I—THE NORMAL AORTA—(*Continued*)

E.B.	50	2.4	7.8	16.8	2.2	7.6	15.8	2.1	4.3	0.96	$\frac{140}{70}$	Normal
D.C.	40	1.9	8.8	19.4	2.2	8.7	17.2	2.0	4.2	1.00	$\frac{114}{74}$	Normal
F.G.	49	2.0	10.1	19.4	1.9	8.5	16.5	1.9	3.8	0.85	—	Normal
R.C.	26	2.2	8.1	18.5	2.3	6.7	15.8	2.3	4.6	0.83	$\frac{130}{95}$	Normal
L.M.	15	2.1	6.7	17.3	2.5	7.6	13.2	1.8	4.3	1.10	$\frac{124}{64}$	Normal
V.W.	16	1.8	6.0	14.7	2.3	6.1	13.5	2.2	4.5	1.00	$\frac{124}{85}$	Normal
L.W.	27	1.8	7.5	18.4	2.4	6.6	12.7	1.9	4.3	0.90	$\frac{104}{64}$	Normal
P.A.	45	2.0	8.7	19.0	2.2	8.5	17.0	2.0	4.2	0.98	$\frac{122}{60}$	Normal
A.P.	37	1.9	8.1	16.0	2.0	7.6	14.3	1.9	3.9	0.94	$\frac{120}{78}$	Normal
C.M.	24	1.9	6.7	17.5	2.5	8.7	16.3	1.9	4.4	1.29	$\frac{110}{76}$	Normal
L.B.	16	2.2	8.3	17.8	2.1	6.5	13.2	2.0	4.1	0.78	$\frac{120}{60}$	Normal
M.A.		1.8	5.5	13.0	2.4	5.5	11.5	2.1	4.5	1.00	—	Normal
M.H.	49	2.0	7.8	15.8	2.0	8.5	14.8	1.8	3.8	1.10	$\frac{124}{80}$	Normal

TABLE 1—THE NORMAL AORTA—(*Continued*)

Case	Age	Index of Rotation	Arch Swing	Diam.(T) Chest	Trans. Index	Arch Height	Diam.(V) Chest	Vertical Index	Sum of Indices	Col. 7 / Col. 4	B.P.	Clinical Findings
C.A.	20	2.0	7.0	17.5	2.5	8.0	16.0	2.0	4.5	1.10	132/90	Normal
M.W.	8	1.8	5.3	13.3	2.5	4.9	10.1	2.1	4.6	0.93	—	Normal
M.S.	22	2.2	7.2	15.4	2.1	6.6	13.0	2.0	4.1	0.92	105/58	Normal
E.H.	39	1.8	8.7	17.0	2.0	8.0	15.6	1.9	3.9	0.92	130/80	Normal
C.T.	17	2.1	7.0	18.5	2.6	5.9	13.2	2.2	4.8	0.85	100/65	Normal
S.M.	40	1.8	8.0	17.0	2.1	7.3	14.5	2.0	4.1	0.90	124/78	Normal
E.B.	34	2.0	7.5	17.4	2.3	7.2	15.0	2.1	4.4	0.96	130/85	Normal
G.F.	56	1.9	9.0	18.0	2.0	7.2	15.2	2.1	4.3	1.05	100/68	Normal
F.R.	43	2.1	9.0	19.2	2.2	8.1	16.3	2.0	4.2	0.90	130/80	Normal
L.H.	23	2.0	7.1	16.2	2.3	6.5	14.1	2.2	4.5	0.91	—	
M.L.	22	1.9	7.2	14.6	2.0	7.0	14.0	2.0	4.0	1.00	112/74	Normal
L.S.	44	2.1	7.8	16.0	2.0	7.0	14.2	2.0	4.0	0.90	112/65	Normal
P.B.	38	2.2	8.0	16.5	2.1	8.0	15.8	2.0	4.1	1.00	120/68	Normal

TABLE I—THE NORMAL AORTA—(*Continued*)

M.H.	16	1.9	6.2	15.2	2.4	5.5	13.0	2.4	4.8	0.90	$\frac{118}{70}$	Normal
M.J.	24	2.2	6.4	16.0	2.5	5.1	10.7	2.1	4.6	0.90	$\frac{100}{60}$	Normal
R.T.	22	1.7	7.0	16.5	2.4	7.5	14.0	1.9	4.3	1.07	$\frac{98}{58}$	Normal
A.M.	11	1.7	5.8	13.0	2.2	6.0	11.7	1.9	4.1	1.04	$\frac{90}{65}$	Normal
B.G.	54	2.2	7.8	17.5	2.2	7.4	15.6	2.1	4.3	0.95	—	Normal
Total 42					93.2			84.4	177.8	40.56		
average					2.2			2.0	4.2	0.97		

TABLE II

THE PATHOLOGICAL AORTA

Variations in Indices Relating to Width and Height of Swing of Aortic Arch With Blood Pressure Determinations

Arteriosclerosis Only

Case	Age	Index of Rotation	Arch Swing	Diam.(T) Chest	Trans. Index	Arch Height	Diam.(V) Chest	Vertical Index	Sum of Indices	Col. 7 Col. 4	B.P.	Pathological Findings
A.V.	57	2.3	13.6	17.5	1.3	9.4	13.6	1.4	2.7	0.69	135/60	Moderate arteriosclerosis
F.V.	69	1.8	11.7	20.4	1.7	9.8	19.0	1.9	3.6	0.84	114/78	Moderate arteriosclerosis
J.S.	72	1.8	11.2	16.5	1.5	10.4	16.5	1.6	3.1	0.93	110/78	Extensive arteriosclerosis
F.S.	43	2.1	11.4	19.3	1.7	7.6	15.5	2.0	3.7	0.66	140/105	Moderate arteriosclerosis
C.D.	71	2.3	13.6	20.5	1.6	10.6	18.0	1.7	3.3	0.77	128/84	Slight arteriosclerosis
J.P.	42	2.5	11.6	18.0	1.6	8.5	15.5	1.7	3.3	0.73	120/90	Moderate arteriosclerosis
H.B.	60	1.7	11.3	18.5	1.7	9.1	16.5	1.8	3.5	0.80	108/80	Slight arteriosclerosis
S.H.	50	—	10.6	18.7	1.8	7.1	13.2	1.9	3.7	0.67	120/80	Moderate arteriosclerosis
M.J.	43	1.6	11.2	18.3	1.7	8.8	16.5	1.8	3.5	0.78	100/76	Slight arteriosclerosis
C.H.	60	1.7	11.6	19.5	1.7	8.0	16.1	2.0	3.7	0.69	100/65	Moderate arteriosclerosis
J.G.	73	1.6	12.7	19.7	1.5	12.7	19.7	1.6	3.1	1.00	130/70	Moderate arteriosclerosis

H.S.	68	—	11.5	20.5	1.8	8.3	16.2	2.0	3.8	0.72	108/58	Slight arteriosclerosis
L.H.	72	2.2	14.0	21.5	1.5	10.5	18.0	1.7	3.2	0.75	125/85	Moderate arteriosclerosis
M.K.	54	2.2	10.0	19.6	1.9	10.0	16.5	1.6	3.5	1.00	114/85	Moderate arteriosclerosis
C.S.	49	2.0	10.7	21.5	2.0	9.0	16.5	1.8	3.8	0.84	130/85	Slight arteriosclerosis
Total 15					25.0			26.5	51.5	11.87		
Average					1.66			1.76	3.43	0.78		

Arteriosclerosis with Clinical Evidence of Hypertension

S.H.	65	2.3	13.3	21.0	1.6	8.6	14.8	1.8	3.4	0.60	186/110	Moderate arteriosclerosis
G.S.	37	2.2	11.5	18.2	1.6	10.3	16.0	1.6	3.2	0.70	220/140	Moderate arteriosclerosis
C.P.	71	1.9	12.7	19.2	1.5	8.6	15.0	1.8	3.3	0.68	164/96	Moderate arteriosclerosis
C.S.	63	2.1	13.0	19.5	1.5	9.3	16.3	1.7	3.2	0.72	158/90	Pronounced arteriosclerosis
T.P.	49	2.5	11.4	19.8	1.7	7.9	14.9	1.9	3.6	0.70	215/110	Extensive arteriosclerosis
R.B.	59	1.7	12.0	20.0	1.7	10.0	17.4	1.7	3.4	0.83	160/70	Moderate arteriosclerosis
E.H.	76	2.1	13.0	18.0	1.4	8.5	14.2	1.7	3.1	0.65	186/90	Extensive arteriosclerosis
W.N.	49	—	11.0	20.0	1.8	6.8	13.0	1.9	3.7	0.62	150/115	Slight arteriosclerosis
S.K.	65	2.2	13.5	18.0	1.3	8.8	13.7	1.5	2.8	0.65	150/90	Extensive arteriosclerosis

TABLE II—THE PATHOLOGICAL AORTA—(*Continued*)

Case	Age	Index of Rotation	Arch Swing	Diam.(T) Chest	Trans. Index	Arch Height	Diam.(V) Chest	Vertical Index	Sum of Indices	Col. 7 / Col. 4	B.P.	Pathological Findings
G.H.	59	2.0	11.7	19.2	1.7	9.8	16.5	1.7	3.4	0.84	150/90	Slight arteriosclerosis
C.M.	57	2.5	10.5	18.5	1.8	6.6	14.0	2.1	3.9	0.63	190/80	Moderate arteriosclerosis
C.B.	56	—	13.4	22.0	1.6	10.0	16.0	1.6	3.2	0.75	178/118	Pronounced arteriosclerosis
Total 12					19.2			21.0	40.2	8.37		
Average					1.6			1.75	3.35	0.70		
Luetic Aortitis, Aneurysm												
C.D.	51	—	11.9	19.6	1.6	9.4	15.0	1.6	3.2	0.79	110/60	Luetic aortitis Moderate arteriosclerosis
J.F.	64	2.1	12.5	18.0	1.4	9.8	16.9	1.7	3.1	0.78	155/50	Luetic aortitis Slight arteriosclerosis
E.S.	61	2.3	14.5	20.5	1.5	14.0	18.2	1.3	2.8	0.97	180/70	Luetic aortitis Aneurysm of arch
E.C.	50	—	10.5	17.0	1.6	7.0	12.0	1.7	3.3	0.66	130/40	Leutic aortitis
F.O.	46	1.9	14.5	19.5	1.3	12.2	19.6	1.6	2.9	0.84	140/70	Luetic aortitis-aneurysm with rupture at diaphragm
Total 5					7.4			7.9	15.3	4.04		
Average					1.48			1.58	3.06	0.81		
Coarctation												
D.R.	57	1.8	10.5	17.0	1.6	8.7	16.2	1.9	3.5	0.83	(122) 86 Arm	Coarctation Pronounced arteriosclerosis

An analysis of the normal group showed an average transverse arch-chest index of 2.2, with variations ranging from 1.9 to 2.5 (Tables I and III). No normal case presented an index below 1.9, which is in marked contrast with those of the pathological group in which the index was 1.9, or below, in all except two cases. Blood pressure determinations in this group were all normal, the systolic varying from 90 to 140; the diastolic from 55 to 95. The ages ranged from four to fifty-six years.

variations ranged from 1.3 to 2.0. At autopsy the arteriosclerosis varied from slight to far-advanced changes. The systolic blood pressure ranged from 100 to 140, the diastolic from 60 to 105. The age period covered by the group was forty-two to seventy-three years. Only two cases in this group showed an index above 1.9, and both of these showed evidence of emphysema at autopsy, and it is possible that the chest measurements were disturbed by this process.

TABLE III

SHOWING AVERAGE AND RANGE OF THE VARIOUS INDICES IN THE NORMAL AND PATHOLOGICAL GROUPS

Pathology	No. Cases	Transverse Index		Vertical Index		Sum of Indices		Height-width Index	
		Av.	Range	Av.	Range	Av.	Range	Av.	Range
Normal	42	2.20	1.9–2.5	2.00	1.8–2.4	4.20	3.7–4.8	0.97	0.70–1.20
Arteriosclerosis	15	1.66	1.3–2.0	1.76	1.4–2.0	3.43	2.7–3.8	0.78	0.66–1.00
Arteriosclerosis with hypertension	12	1.60	1.3–1.8	1.75	1.5–2.1	3.35	2.8–3.9	0.70	0.60–0.84
Syphilis	5	1.48	1.3–1.6	1.58	1.3–1.7	3.06	2.8–3.3	0.81	0.66–0.97
Coarctation	1	1.60		1.90		3.50		0.83	

The cases in which pathological changes were found at autopsy were divided into the following groups: (1) arteriosclerotic cases which did not show evidence of hypertension clinically; (2) arteriosclerotic cases with clinical evidence of hypertension; (3) luetic cases with or without aneurysm; (4) coarctation. The transverse index of each case of these groups was determined. These indices were analyzed according to their group (Tables II and III) and representative illustrations have been selected from the groups to portray the character of changes observed between the normal and pathological case.

The transverse arch-chest index of the arteriosclerotic group of 15 cases was found to be 1.6 for the entire group. Individual

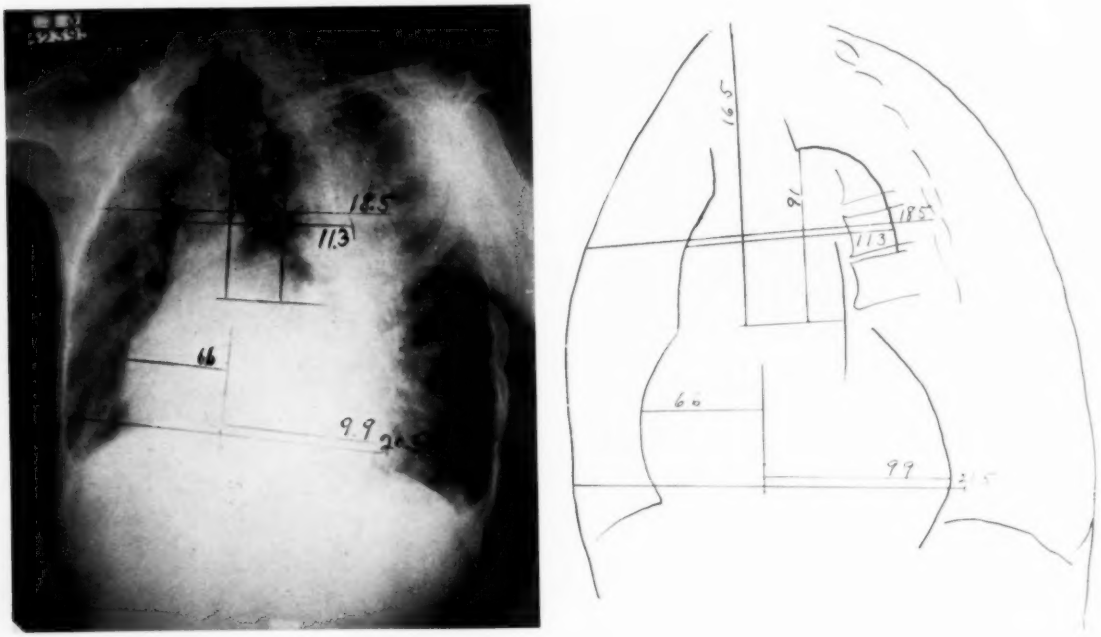
Figures 4 and 5 represent the left oblique film and tracing of a sixty year old male who entered the hospital complaining of shortness of breath and stomach trouble. His heart was found to be enlarged on percussion. A prominent systolic murmur was heard over the entire precordium; a diastolic murmur was best heard to the left of the sternum. There was also a systolic thrill at the base of the heart. His blood pressure was 108/80. The measurements of the aortic arch indicated an abnormal swing. The transverse arch-chest index was 1.7, derived by dividing the diameter of the chest (18.5 cm.) by the cord diameter of the arch (11.3 cm.).

At autopsy, a definite aortic stenosis with insufficiency was found, with a mas-

sive left ventricular hypertrophy. Arteriosclerotic changes were found in the aorta, not marked in degree for the patient's age.

Cases which showed hypertension clinically and arteriosclerotic changes at autopsy (12 cases) are presented in a separate group. The average index of this group was 1.6, with variations in individual cases of 1.3 to 1.8. All the cases of this group, it will be noted, present a transverse arch-chest index below 1.9, the lowest index found in the normal group. The blood pressure detial hypertension. The percussion outlines of the heart suggested marked enlargement. No diagnostic murmurs were heard. The transverse arch-chest index of the arch was found distinctly low (1.6).

His course was unfavorable, death resulting approximately four months after his first admission. At autopsy the aorta was found moderately arteriosclerotic, without ulceration or calcification. The heart was generally enlarged with a particularly heavy left ventricle, and weighed



Figs. 4 and 5. Arteriosclerosis of aorta with abnormal variations in the transverse and vertical indices of the aortic arch. The patient died as the result of a marked aortic stenosis of rheumatic origin. The arteriosclerotic changes were not pronounced particularly for the patient's age, but in spite of the slight degree of arteriosclerosis, the transverse and vertical indices of the aortic arch appear definitely abnormal. The width across the limbs of the arch was found to be 11.3 cm., while the chest measurement was 18.5 cm., yielding a low transverse index of 1.7. Similarly, the height index was found to be low (1.8), the height of the arch measuring 9.1 cm. and the chest measurement (above the cardiac level) 16.5 cm. The height-width index of the arch was also somewhat low (0.80). At autopsy his arteriosclerosis was described as rather slight in degree; the heart was nearly twice normal size, weighing 800 grams, with a particularly massive left ventricle.

terminations, pathological findings, and indices are indicated in Table II.

The left oblique film and tracing of a patient who showed marked hypertension (blood pressure 220/160) during life are illustrated in Figures 6 and 7. This patient showed a clinical course suggesting essen-

900 grams. There was also evidence of an acute and chronic nephritis, extensive tuberculosis of the right kidney with total destruction, tuberculosis of prostate, and an adhesive pericarditis.

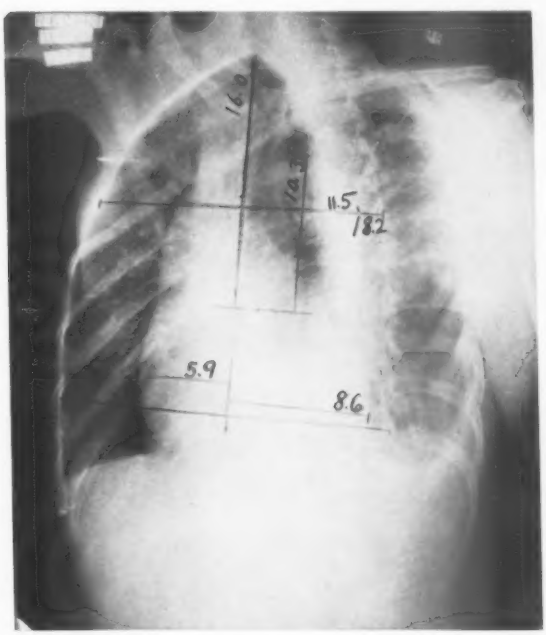
Five luetic cases were similarly examined, obtaining an average index of 1.5,

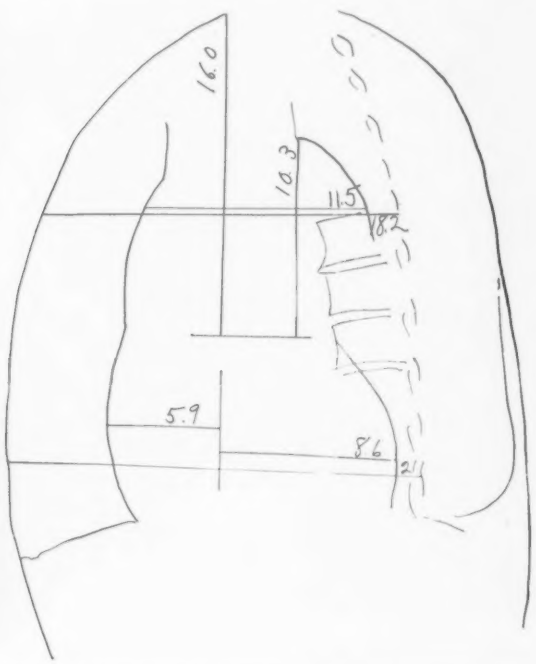
with individual variations of 1.3 to 1.6 (Table II). Thus no case in this group presented an index similar to the normal group. Pulse pressures in this group were high; in several cases it exceeded 100.

A case of luetic aortitis with relatively slight involvement of the aorta is illustrated in Figures 8 and 9. The transverse arch-chest index of this patient was found to be 1.4. His death on the day following roentgenologic examination was not the result of cardiovascular disease, but was due to a complication resulting from a large foreign body (plate of false teeth) in the esophagus. At autopsy, the heart was not enlarged in size (weight 350 grams), though there was definite involvement of the aortic valve. His accidental death afforded an opportunity to study early luetic changes in the heart and aorta. In addition to a typical luetic wrinkling of the aorta, there were a few small atheromata characteristic of arteriosclerosis.

A single case of coarctation likewise showed a definitely low transverse index of 1.6.

The transverse index just discussed attempts to measure the degree of separation of the two limbs of the aortic arch, correlating the measurement with a transverse diameter of the chest. The elongation of the aorta resulting from its loss in elasticity produces another effect which appeared measurable. This relates to the increased height of the aortic arch resulting from diffuse elongation. The base of the heart bears a relatively fixed position in relation to the chest (in regard to the vertical plane





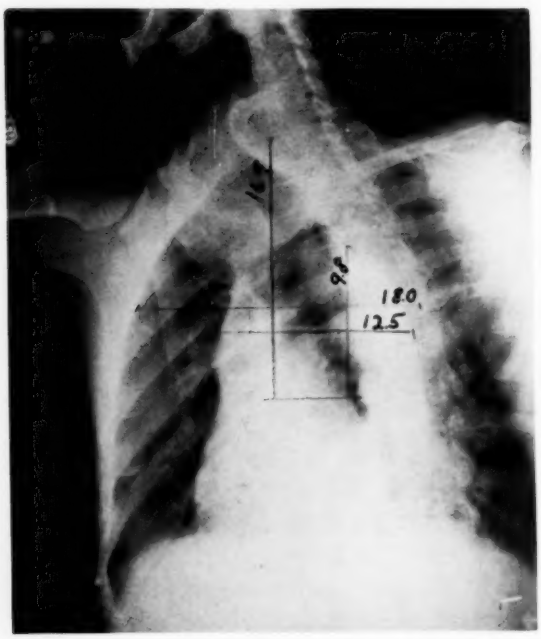
Figs. 6 and 7. Moderate arteriosclerosis of aorta associated clinically with evidence of marked hypertension. The clinical picture of this patient was one of essential hypertension (blood pressure 220/160). When the transverse chest measurement (11.5 cm.) is divided by the cord diameter of the arch (10.3 cm.) a definitely low transverse arch index (1.6) is obtained. The vertical index of the arch is similarly low ($16 \div 10.3 = 1.6$). A disproportion is also noted in the relation of the height to the width of the arch (0.70). In addition the cardiac measurements indicate a generally enlarged heart, with a more marked enlargement on the left side. At autopsy a moderate degree of arteriosclerosis was found in the aorta without evidence of ulceration or calcification. The heart was enormously enlarged (900 grams) with a particularly massive left ventricle and with less marked dilatation and hypertrophy of the right side.

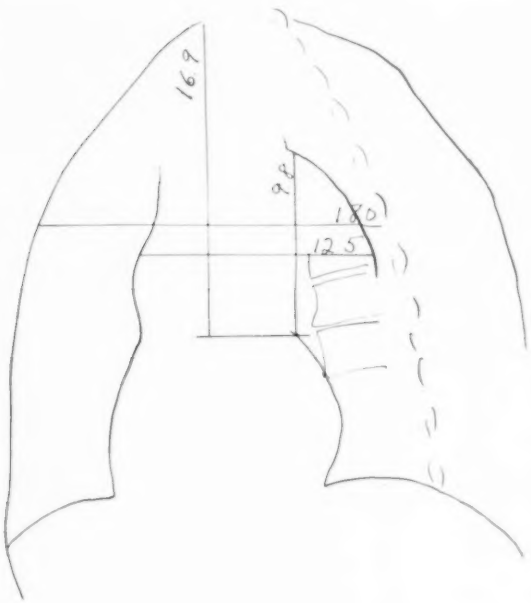
of the body) due to the anchorage effected by the great vessels. It shows practically no respiratory excursion and is not modified by position or respiration. The base of the heart, therefore, furnishes a very suitable base line for measuring the height of the arch. The position for this line was taken in each case, as shown in Figures 2 and 3. The notch formed by ascending aorta and right border of the heart furnishes an easily determined level. The chest measurement taken for purposes of correlation was the vertical diameter from the base of the heart to the plane of the first rib (superior aperture of the chest).

The most convenient point on the arch for determining the height of the arch was found to be at the place of origin of the left subclavian artery, while for determining the height of the chest above the cardiac level, the plane of the first rib on the right side was selected.

This latter measurement was divided by the former to obtain an index which will be referred to as the vertical arch-chest index. Measurements of the arch and chest were made without difficulty, throughout the series of normal and pathological cases. The variations in this index are tabulated according to groups in Table III.

The normal series presented an average index of 2.0 for the entire group of 42 cases. Variations ranged from 1.8 to 2.4. Figures 2 and 3 illustrate a normal arch with a vertical index of 2.0 and a transverse index of 2.1. In the series in which arteriosclerosis was the only finding at autopsy relating to the aorta, the average vertical index was 1.76, with variations of 1.4 to 2.0. Slight arteriosclerosis of the aorta is illustrated





Figs. 8 and 9. Case of luetic aortitis associated with very slight arteriosclerotic changes. The patient, a male, aged sixty-four, died as the result of swallowing a lower plate of false teeth. From the measurements of the aortic arch and chest, low indices are obtained. When the transverse chest measurement (18.0 cm.) is divided by the cord diameter of the arch (12.5 cm.) a low index of 1.4 is found. The vertical index of the arch is also somewhat low (1.7), though this change is less marked than in the case of the transverse arch index. Some disproportion between the height and width of the arch is suggested by the low index of 0.78. At autopsy the heart did not appear enlarged (weight 350 grams). The aorta showed a typical cherry-bark wrinkling, suggestive of a luetic process. There were, in addition, a few small atheromata suggestive of arteriosclerosis.

by Figures 4 and 5. This sixty year old man died as a result of aortic stenosis. Arteriosclerotic changes in the aorta are suggested by the definitely low transverse arch index. The vertical index of this arch is suggestively low. It does not show the marked variation from normal found in the case of the transverse index.

Cases showing hypertension clinically and arteriosclerosis at autopsy yielded a vertical index (1.7) practically identical with that of the arteriosclerotic group without evidence of hypertension, with a range of variations of 1.5 to 2.1. Figures 6 and 7 represent the film and tracing of an individual with marked hypertension (blood pressure 220/140). The vertical index was found to be 1.6 (16.0 divided by 10.3 = 1.6). At autopsy a moderate arteriosclerosis was noted.

The small series of syphilitic aortitis presented an index slightly lower than those of arteriosclerosis or arteriosclerosis and hypertension, and much lower than the normal series. The average vertical index for these was 1.58, with individual variations of 1.3 to 1.7. Figures 8 and 9 illustrate a case of luetic aortitis with a low vertical index of 1.7 (16.9 divided by 9.8 = 1.7).

In comparing the indices of the normal and pathological group, it will be noted that the transverse arch-chest index gave consistently a much sharper separation of the normal and abnormal groups than the vertical arch-chest index. Only 2 out of 33 cases showing pathology in the aorta at autopsy gave a transverse arch-chest index above 1.8 (lower limit of normal series 1.9), while the vertical arch-chest indices of 9 cases of this same group were above the lower limit of range of the normal group of 1.9. The same holds true for the normal group. The transverse arch-chest index in every case of the normal group was 1.9 or above, while 4 normal cases presented a vertical arch-chest index below 1.9. The errors regarding false normals and false abnormals are listed according to their various indices in Table IV, where the sharper separation of the abnormal from the normal by means of the transverse index becomes apparent at a glance. The more valuable index, therefore, would appear to be the transverse index, although it is evident that the vertical index is valuable in that it separated out the normals from the pathological in over four-fifths of the entire series of 75 cases.

TABLE IV

INDICATING THE NUMBER OF CASES INCORRECTLY IDENTIFIED BY THE SEVERAL INDICES OF THE AORTIC ARCH

Arch Index	Total No. Cases	Number of False Normals	Number of False Abnormals	Per cent Correct	Lower Range Limit of Normal
Transverse	75	0	2	97	1.90
Vertical	75	4	9	82	1.90
Sum of Indices	75	1	3	95	3.80
Height-width Index	75	3	4	90	0.85

The vertical index of the arch serves as a valuable check on the transverse index. Thus, of the 2 cases of arteriosclerosis missed by the transverse index (which showed indices of 1.9 and 2.0), one showed a very low vertical index (1.6) and the other was suggestively low (1.8).

In the normal group, the vertical index should not be confusing, for while there were 4 normal cases (out of a total of 42) which showed an index below 1.9, all four of these presented a transverse arch index within normal limits of 1.9 or above.

For this reason it was thought advisable

to obtain the sum of these two indices. In the normal group the average becomes 4.2, with range of variation of 3.7 to 4.8. One case only, out of 42, was below 3.8, which probably should be accepted as the lower limit of normal. In examining the series of abnormal aortas only 3 are found above 3.7. Out of 75 cases, therefore, only 4 would fail to be recognized correctly as normal or abnormal, if the sum of these indices above were relied upon.

A further correlation, not related to the measurement of the chest, directly concerns the proportions of the arch in the height and width of its swing. To obtain a relation between the height and width of the swing of the arch, the former was divided by the latter. This determination (termed the height-width index) was made throughout the series of normal and abnormal aortas. The average height-width index for the normal series was found to be 0.97 (practically unity). There were rather wide variations, however, in individual cases, ranging from 0.71 to 1.20. All 42 normal cases showed an index of 0.85 or above, except for 3 cases (of youthful individuals whose hearts were found markedly enlarged at autopsy). It is possible that the disproportion between the height and width of the arch is the result of marked cardiac enlargement, producing a separation of the two limbs of the arch, thereby reducing its comparative height.

In the group which showed abnormal aortas at autopsy, the average height-width index was lower in the arteriosclerotic and luetic cases. The average index of the 15 arteriosclerotic cases without clinical evidence of hypertension was 0.78, with variations ranging from 0.66 to 1.00; the 12 cases with clinical evidence of hypertension presented an average index of 0.70, with a range of 0.60 to 0.84. The index relating to the luetic cases was similar. The indices of the ones showing evidence of aneurysm varied widely, depending on size and location of aneurysm. Only 4 cases in all these groups of 33 cases showed an index above 0.85, although 6 others fell within the range 0.80 and 0.85.

It becomes apparent that the normal arch usually shows a width and height of swing of equal or nearly equal magnitude, producing a height-width index approaching unity. There are exceptions to this rule which renders the interpretation of individual cases more difficult, however. In most instances the index is found to be above 0.85. The cases presenting abnormal changes in the aorta at autopsy showed a lower index for the group than the normal series, and in all except 4 cases was below 0.85 (Tables III and IV).

SUMMARY

An attempt has been made to establish correlative measurements pertaining to the height and width of the arc described by the aortic arch in the left oblique position with appropriate chest measurements. A transverse arch-chest index has been described, which permits sharp separation of the normal from the abnormal arch in a series of 75 cases. The normal aorta presented an average transverse arch-chest index of 2.2, with a lower limit of normal of 1.9. The pathological aortas, whether associated with arteriosclerosis, arteriosclerosis and hypertension, syphilis, or coarctation, all showed an index below 1.9, with two exceptions.

A vertical arch-chest index which correlates the height of the arch with a vertical chest diameter was also found helpful in identifying pathological changes, although the accuracy of this index was not as high as that of the transverse index. The average index for the normal group was found to be 2.0, with a lower range limit of 1.9. Using this range limit for a guide, 4 normals are found to fall below this range and 9 abnormal cases above this limit. This index was found particularly helpful in 2 cases which were found to be arteriosclerosis at autopsy and which showed a transverse arch-chest index within the lower limit of normal. The vertical arch-chest indices of these two cases were low.

By correlating the height of the aortic arch with the width of its swing, a height-width index was established which was found of value as a supplementary aid. As an isolated finding, it possesses much less importance. In the normal group this index was found to be approximately 1.0. Using 0.85 as the lower range limit of normal, 3 normal cases were found to show an index below this figure and 4 cases with pathological changes above it.

While these indices were found to be of great value in distinguishing the abnormally shaped aortic arch from the normal, it should be noted that none of these impart any information concerning the type of pathology responsible for the distortion of the arch. Arteriosclerosis, either with or without hypertension, syphilis, and coarctation all appear to alter these indices in much the same way, i.e., by lowering the value of the several indices. This should be expected since the alteration in these indices simply reflects the degree of elongation or stretching of the aorta resulting from its loss of elasticity. This loss in elasticity is to be expected in cases of arteriosclerosis; in cases of syphilis where the process has involved a considerable part of the arch, or where arteriosclerosis is combined with syphilis; in cases of coarctation where arteriosclerosis so frequently and extensively involves the aorta proximal to the obstruction.

After the recognition of an aortic arch of abnormal configuration has been made, supplementary aids are required if the type of pathology present is to be determined. The process of elimination is usually helpful in completing the diagnosis, since the number of possibilities is limited. The presence of calcium plaques and definite buckling make a diagnosis of arteriosclerosis quite certain. If these are absent, coarctation, syphilis and arteriosclerosis all remain as possibilities. The diagnosis of coarctation is usually made without difficulty by identifying the local defect in the aortic arch or the erosion of ribs produced by the collateral circulation. The presence of an aneurysm or local dilatation in the proximal ascending aorta is commonly the result of syphilis (if coarctation has been ruled out). If coarctation and syphilis can both be eliminated as possibilities, the changes observed in practically all instances will be due to arteriosclerosis (either with or without a history of hypertension).

The differentiation of cases of arteriosclerosis without clinical evidence of hypertension from cases of hypertension without arteriosclerotic changes may be difficult. Cases of hypertension arising from a nephritic process often show some increase in the width of the swing of the arch, but do not show evidence of calcification or buckling (unless arteriosclerosis is present). Many cases of nephritis with hypertension in youth, even though the blood pressure may be very high, do not show any demonstrable change roentgenologically.

The chief error in this process of elimination lies in the difficulty of excluding a syphilitic process with certainty. Its recognition is dependent upon identifying a local dilatation and cannot be made by any roentgenological means at our command prior to such dilatation. The presence of a definite local dilatation in the proximal aorta, without evidence of calcification or buckling of the aorta, or the presence of an aneurysm, favors a syphilitic process. A syphilitic aorta, however, may not dilate locally; it may involve a considerable portion of the aortic arch and not be restricted to the proximal portion of the ascending aorta; when dilatation does occur it may involve the arch diffusely without producing a saccular aneurysm. Arteriosclerosis not infrequently produces slight local dilatations which may be confused with lues. Such cases practically invariably show evidence of buckling or calcification if a Potter-Bucky technique is used. Thus, in the majority of cases, if the aortic arch can be identified as abnormal, there are accessory signs such as the presence of calcification, buckling, local dilatation, aneurysm or

local defect in the aortic arch which aid one materially in obtaining a correct impression of the type of pathology present without resorting to clinical information.

CONCLUSIONS

1. The normal course of the aortic arch in the left anterior oblique chest film has been described, using several correlative indices as a guide.

2. Pathological changes within the aortic arch were found to alter these indices so as to permit the identification of an aortic arch with an abnormal configuration.

3. A transverse arch-chest index was found to sharply separate the cases with a normal aorta from those which were found abnormal at autopsy. In a group of 75 cases only 2 failed to be correctly identified by this method.

4. A vertical arch-chest index and a height-width index of the arch were also found of value, though the separation of the normal from the abnormal did not show the accuracy noted in the case of the transverse arch-chest index.

5. The normal arch was found to be one with a transverse arch-chest index above 1.8, and usually gave a vertical arch-chest index above 1.8 and a height-width index above 0.85.

6. Arteriosclerosis, syphilis, and coarctation were found to lower the transverse and vertical arch-chest indices to a value below 1.9, and generally lowered the height-width of the arch below 0.85.

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EDITORIAL

HEPATOGRAPHY AND LIENOGRAPHY

THE spleen as an organ has been known since the ancient times. Galen considered it to be an organ "full of mystery" and Pliny states that it "may be taken out of the body by way of incision, and yet the creature live nevertheless." Our physiological knowledge of the spleen began with Malpighi, and until comparatively recent years little knowledge has been added to his early observations. With the discovery of the reticulo-endothelial system and its intensive study by Aschoff and his pupils, a new interest was aroused in the spleen and liver and their functions. The roentgen ray has contributed very little in a diagnostic way other than to demonstrate the size and position of the liver and spleen, and at times this could be done accurately only by the use of contrast shadows after the introduction of air into the stomach or colon for the visualization of the spleen or the use of an opaque enema for the demonstration of the size and position of the liver and spleen, though with the advent of the Potter-Bucky diaphragm their shadows could be shown with considerable facility without the use of contrast media.

With the idea of better visualization of the liver by means of some opaque substance Einhorn and Stewart[1] in 1927 first tried tetraiodophenolphthalein. Their experience with this dye was that it gave insufficient clarity of the hepatic shadows to demonstrate the finer structural changes.

Shortly after their work, Oka[2] of Japan, in 1929, during the course of some animal experiments for bronchography with thorium dioxide sol accidentally found that the spleen and liver of the animals became visible to the roentgen rays. The intravenous injection of one single large dose of the thorium led to a good visualization of these organs but the experimental animals died suddenly from shock. Later the administration of the thorium in repeated smaller doses increased the tolerance limit of the animals, no toxic effects having been observed. The post-mortem examination of the animals revealed the fact that the thorium was lodged in the reticulo-endothelial cells throughout the body, particularly those of the liver and spleen. The question then arose as to whether the storage of the thorium particles in the reticulo-endothelial system might not lead to a disturbance of this system. Oka conducted experiments with this thought in mind and it was determined that if the injections were carried out with repeated small doses, no functional disturbance could be noted even after a lapse of several months. In view of these findings the method was tried in six humans and in none of the cases injected were there any serious disturbances, although slight fever with or without chills, diarrhea and headaches were observed in some of the cases. Good visualization of both the liver and spleen was obtained.[3]

Following this, further work was done by Radt[4] upon the contrast medium, thorium dioxide sol, with the view to making it still less toxic. The preparation evolved was known as thorotrast and was used both experimentally and clinically by Radt with satisfactory results. The clinical use of thorotrast has also been reported by Ste-

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wart, Einhorn and Illick,[5] Kadrnka,[6] and Tripoli, Haam and Lehman.[7]

Stewart, Einhorn and Illick, after its use in eight cases, call attention to the fact that while their studies demonstrate that excellent hepatic and splenic outlines and detail are obtainable, the thorium is retained indefinitely in the liver and spleen and that the injection is sometimes followed by very severe reactions. They conclude from their study that the test does not seem to yield enough independent information to justify its use except in unusual cases.

In the light of the experience of these authors, the intravenous injection of this dye for roentgenography of the human liver and spleen should be restricted. But while its clinical application may be limited the possibilities in the field of research are considerable, and it is to be hoped that by its experimental use various phases of "reticulo-endothelial activity" may be studied as thus far in the spleen and liver, particularly the spleen, the roentgen ray has contributed very little except as regards the change in its shape and size in normal and pathological states or under the influence of exercise and various drugs.

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SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

Items for this section solicited promptly after the events to which they refer.

MEETINGS OF ROENTGEN SOCIETIES*

United States of America

American Roentgen Ray Society
Secretary, Dr. E. P. Pendergrass, University Hospital, Philadelphia, Pa.
Annual Meeting: Detroit, Mich., Sept. 27-30, 1932.

American College of Radiology
Secretary, Dr. Albert Soiland, 1407 S. Hope St., Los Angeles, Calif.
Annual Meeting: New Orleans, La., May, 1932.

Section on Radiology, American Medical Association
Secretary, Dr. G.W. Grier, Jenkins Arcade, Pittsburgh, Pa.
Annual meeting: New Orleans, La., May 9–13, 1932.

Radiological Society of North America
Secretary, Dr. D. S. Childs, 607 Medical Arts Bldg., Syracuse, N. Y.
Annual Meeting: Atlantic City, N.J , Nov. 28-Dec. 2, 1932.

Radiological Section, Los Angeles County Medical Society
Secretary, Dr. D. R. MacColl, 2826 S. Hope St., Los Angeles, Calif.
Meets on the third Wednesday of each month at the California Hospital.

Radiological Section, Southern Medical Association
Secretary, Dr. C. H. Heacock, 20 S. Dunlap St., Memphis, Tenn.
Annual meeting: Birmingham, Ala., Nov. 16-18, 1932.

Brooklyn Roentgen Ray Society
Secretary, Dr. J. J. Masterson, 401–76th St., Brooklyn, N. Y.
Meets monthly on first Tuesday, October to April.

Buffalo Radiological Society
Secretary-Treasurer, Dr. Joseph S. Gian-Franceschi, 610 Niagara St., Buffalo, N.Y.
Meets second Monday of each month except during summer months, place of meeting selected by the host.

Chicago Roentgen Society
Secretary, Dr. George M. Landau, 660 Groveland Park.
Meeting second Thursday of each month October to May inclusive at Virginia Hotel.

Cincinnati Radiological Society
Secretary, Dr. H. G. Reineke, Christian R. Holmes Hospital, Cincinnati, Ohio.
Meetings held monthly.

Cleveland Radiological Society
Secretary, Dr. M. A. Thomas, Medical Arts Bldg.
Meetings are held at 6:15 P.M. at the Cleveland Chamber of Commerce Club rooms on the fourth Monday of each month from October to April, inclusive.

Detroit Roentgen Ray and Radium Society
Secretary, Dr. E. R. Witwer, Harper Hospital.
Meets monthly on first Thursday from October to May, at Wayne Country Medical Society Building.

Florida Radiological Society
Secretary, Dr. F. K. Herpel, Good Samaritan Hospital, West Palm Beach, Fla.
Meetings held twice a year, May and November.

Illinois Radiological Society
Secretary, Dr . L. M. Hilt, Myers Bldg., Springfield, Ill.
Regular meetings held quarterly.

Indiana Roentgen Society
Secretary, Dr. J. N. Collins, Indianapolis, Ind.
Annual meeting each February 22 in Indianapolis.

Milwaukee Roentgen Ray Society
Secretary, Dr. J. E. Habbe, 221 Wisconsin Ave., Milwaukee, Wis.
Meets first Friday in October, December, February and April.
Place of meeting designated by the president.

Minnesota Radiological Society
Secretary, Dr. L. G. Rigler, University Hospital, Minneapolis, Minn.
Next Meeting: St. Paul, Minn., May 23, 1932.

New England Roentgen Ray Society
Secretary, Dr. Thomas R. Healy, 370 Marlboro St., Boston, Mass.
Meets monthly on third Friday, Boston Medical Library.

New York Society
Secretary, Dr. J. Bennett Edwards, Englewood Hospital Englewood, N. J.
Meets monthly on third Monday, New York Academy of Medicine, at 8:30 P.M.

Central New York Roentgen Ray Society
Secretary, Dr. M. T. Powers, 250 Genesee St., Utica, N. Y.
Three meetings a year—January, May and November.

Pennsylvania Radiological Society
Secretary, Dr. W. E. Reiley, Clearfield, Penna.
Next Meeting: Philipsburg, Pa., May 18–19, 1932.

Philadelphia Roentgen Ray Society
Secretary, Dr. Karl Kornblum, 3400 Spruce St.
Meeting first Thursday of each month from October to May inclusive, at 8:15 P.M., in Thomson Hall, College of Physicians, 19 S. 22d St.

Rochester Roentgen Ray Society, Rochester, N. Y.
Secretary, Dr. Camp C. Thomas, 476 Lake Ave.
Meets monthly on the first Friday evening at 7:45 at the Rochester Medical Association Building.

St. Louis Roentgen Club
Secretary, Dr. W. K. Mueller, University Club Bldg.
Meets first week of each month. Time and place of meetings designated by president.

Texas Radiological Society
Secretary-Treasurer, Dr. C. P. Harris, Houston, Texas.
Meets annually one day preceding the meeting of the Texas State Medical Association.

University of Michigan Roentgen Ray Society
Secretary, Dr. C. C. Taylor, University Hospital, Ann Arbor, Mich.
Meets first and third Wednesday evening of the month from October to June, at 8 o'clock in the amphitheatre of the University Hospital.

* Secretaries of Societies not here listed are requested to send the necessary information to the Editor.

Virginia Roentgen Ray Club
Secretary, Dr. Wright Clarkson, 205 S. Sycamore St., Petersburg, Va.
Meets annually in October.
Next meeting: Richmond, Va., October, 1932.

Cuba

Sociedad Cubana de Radiologia y Fisioterapia
Secretary, Dr. Francisco Padron, Enrique Villuendas 64, Havana, Cuba. Meets monthly in Havana.

British Empire

British Institute of Radiology Incorporated with the Röntgen Society
Meets on the third Thursday of each month, from November to June inclusive, at 8:15 p.m., at 32 Welbeck St., London, W. 1., or as advertised.

Electro-Therapeutic Section of the Royal Society of Medicine (Confined to Medical Members)
Meets on the third Friday of each month during the winter at 8:30 p.m. at the Royal Society of Medicine, 1 Wimpole St., London, W. 1.

Section of Radiology and Medical Electricity, Australasian Medical Congress
Secretary, Dr. H. M. Cutler, 139 Macquarie St., Sydney, New South Wales.

Radiological Section of the Victorian Branch of the British Medical Association
Secretary, Dr. Colin Macdonald, Lister House, 61 Collins St., Melbourne, Australia.
Meets monthly at Melbourne during the winter.

Section on Radiology, Canadian Medical Association
Secretary, Dr. A. H. Rolph, 160 St. George St., Toronto, Ont.

Radiological Section, New Zealand British Medical Association
Secretary, Dr. P. C. Fenwick, The Hospital, Christchurch. Meets annually.

Continental Europe

Belgian Society of Roentgenology
Secretary, Dr. J. Boine, Avenue des Allies, 134, Louvain (Belgium).
Meets monthly on second Sunday at d'Egmonds Palace, Brussels, except in the summertime.

Societe de Radiologie Médicale de France
Meets monthly on second Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

Société Suisse de Radiologie (Schweizerische Röntgen-Gesellschaft)
Secretary for French language, Dr. A. Grosjean, La Chaux de Fonds.
Secretary for German language, Dr. Scheurer, Molzgasse, Biel.
Meets annually in different cities.

Société Francaise d'Electrothérapie et de Radiologie Médicale
Meets monthly on fourth Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

Association of German Roentgenologists and Radiologists in Czecho-Slovakia
Secretary, Dr. Walter Altschul, German University, Prague, II/52.

Deutsche Röntgen-Gesellschaft (Gesellschaft für Röntgenkunde und Strahlenforschung)
Meets annually in April, alternating one year in Berlin, one year in some other German city. Meets in addition every two years with the Gesellschaft deutscher Naturforscher und Aerzte.
Permanent secretary, Professor Dr. Haenisch, Klopstockstrasse 10, Hamburg, Germany.

Süd-und Westdeutsche Röntgengesellschaft
Meets annually in different cities.

Nord- und Ostdeutsche Roentgengesellschaft
Meets annually in different cities.

Dutch Society of Electrology and Roentgenology
Holds two meetings a year in Amsterdam, one in the Spring, and one in the Fall.

Societa Italiana Radiologia Medica
Secretary, Professor M. Ponzio, University of Turin, Turin.

Societatea Romana de Radiologie si Electrologie
Secretary, Dr. Oscar Meller, Str. Banul Maracine 30, Bucarest, Rumania.
Meets second Monday in every month with the exception of July and August.

All-Russian Roentgen Ray Association, Leningrad, USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs. S. A. Reinberg and S. G. Simonson.
Meets annually.

Leningrad Roentgen Ray Society
Secretaries, Drs. S. G. Simonson and G. A. Gusterin.
Meets monthly, first Monday at 8 o'clock, State Institute of Roentgenology and Radiology, Leningrad.

Moscow Roentgen Ray Society
Secretaries, Drs. L. L. Holst, A. W. Ssamygin and S. T. Konobejevsky.
Meets monthly on the first Monday at 8 o'clock, the place of meeting being selected by the Society.

Polish Society of Radiology
Secretary, Dr. Jan. Kochanowski, 45 Gornoslazka St., Warsaw. Meets annually.

Warsaw Section, Polish Society of Radiology
Secretary, Dr. B. Krynski, 11 Zielna St.
Meets once a month except in the summertime.

Scandinavian Roentgen Societies
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association. Each of the following societies, with exception of the Denmark Society, meets every second month except in the summertime.

Society of Medical Radiology of Sweden
Meets in Stockholm.

Society of Medical Radiology in Norway
Meets in Oslo.

Society of Medical Radiology in Denmark
Secretary, Dr. G. Biering, Copenhagen.
Meets on the second Wednesday of each month from October to July in Copenhagen, at 8 o'clock in the State Institute of Roentgenology.

Society of Medical Radiology in Finland
Meets in Helsingfors.

Vienna Society of Roentgenology
Secretary, Professor Holzknecht, Vienna, IX, General Hospital.
Meets first Tuesday each month, October to July.

Orient

Japan X-ray Association
c/o Orthopedic Surgery, Tokyo Imperial University.
Meets annually in April.

Kinki Roentgen-Abend Society
Director, Dr. Prof. Taiga Saito, Ogawaoike Tyoto, Japan. Meets bi-monthly on third Sunday.

PROGRAM

OF THE

AMERICAN RADIUM SOCIETY

MAY 9-10, 1932,

ROOSEVELT HOTEL, NEW ORLEANS, LA.

SYMPOSIUM ON CANCER OF THE SKIN

Chairman, Dr. Wm. S. Newcomet, Philadelphia

May 9—10.00 a.m.

1. Dr. Laurence R. Taussig, San Francisco. The treatment of Epithelioma of the Skin. Indications for Radium Therapy.
2. Dr. Max Cutler, Chicago (by invitation). Radiation Treatment of Cancer of the Skin.
3. Dr. Chas. L. Martin, Dallas, Texas. The Advantages of Radiation in the Treatment of Skin Carcinoma.
4. Dr. Geo. M. MacKee, New York (by invitation). Methods of Treatment of Cancer of the Skin.

Discussion: To be opened by: Dr. Lester Hollander, Pittsburgh. Additional discussions by: Dr. William H. Cameron, New York; Dr. L. R. Sante, St. Louis.

5. Dr. Russell S. Ferguson, New York. The Effect of External Radiation on the Hormone of the Anterior Hypophysis in Treatment of Teratoma Testis.

Discussion: To be opened by:

2:00 p.m.

6. Dr. D. G. Morton, San Francisco (by invitation). Cancer of the Cervix Uteri.
7. Dr. Henry Schmitz, Chicago. The Results Obtained with the Scattered Fraction Method of Irradiation of Carcinoma of the Uterine Cervix.

SYMPOSIUM ON RADIATION THERAPY FOR UTERINE HEMORRHAGE OF NON-MALIGNANT ORIGIN

Chairman, Dr. E. H. Skinner, Kansas City

8. Dr. A. U. Desjardins, Rochester, Minnesota. Radiotherapy for Benign Hemorrhage of the Uterus.
9. Dr. Jas. A. Corscaden, New York. Treatment of Uterine Fibroids.
10. Dr. O. L. Norsworthy, Houston, Texas. Benign Uterine Neoplasms with Special Reference to Treatment.

Discussion of five preceding papers: To be opened by Dr. C. Jeff Miller, New Orleans (by invitation); Dr. Wm. P. Healy, New York.

SYMPOSIUM ON CERVICAL NODES METASTATIC FROM INTRAORAL CANCER

Chairman, Dr. Maurice Lenz, New York

May 10—9:30 a.m.

11. Dr. Vilray P. Blair, St. Louis (by invitation). Care of the Lymphatic Drainage Areas of the Neck.
12. Dr. Calvin B. Stewart, Atlanta (by invitation). Neck Care in Intraoral Malignancies.
13. Dr. Ellis Fischel, St. Louis (by invitation). Treatment of Cervical Nodes Metastatic from Intraoral Cancer.
14. Dr. James J. Duffy, New York. Management of Cervical Nodes Metastatic from Intraoral Cancer.

Discussion: To be opened by: Dr. Edwin C. Ernst, St. Louis. Additional discussions by Dr. Urban Maes, New Orleans (by invitation); Dr. Geo. W. Grier, Pittsburgh.

15. Dr. Henry Pancoast, Dr. E. P. Pendergass (by invitation) and Dr. Gabriel Tucker (by invitation), Philadelphia. Treatment of Appropriate Cases of Cancer of the Bronchus and Esophagus by Supplemental Radon Implantation.

Discussion: To be opened by Dr. Henry J. Ullmann, Santa Barbara, California.

2:00 p.m.

16. Mrs. E. H. Quimby, New York (by invitation). Dosage from Long Radium or Radon Needles.

Discussion: To be opened by Mr. J. L. Weatherwax, Philadelphia (by invitation).

SYMPOSIUM ON CANCER OF THE LIP

Chairman, Dr. Frank E. Simpson, Chicago

17. Dr. Chas. C. Lund, Boston (by invitation). Analysis of the Treatment of Cancer of the Lip at the Huntington Hospital from 1918 to 1926.
18. Dr. B. F. Schreiner, and Dr. W. L. Mattick (by invitation), Buffalo. Five Year End-Results in the Treatment of Cancer of the Lip. (N. Y. State Institute for the Study of Malignant Disease.)
19. Dr. O. H. Wangensteen, Minneapolis. Report of Cases of Cancer of the Lip, at Cancer Institute, University of Medicine, Medical School.
20. Dr. Jerome Webster, New York. The Operative Treatment of Epithelioma of the Lip.

Discussion: To be opened by Dr. Alton Ochsner, New Orleans (by invitation). Additional discussion by: Dr. Rollin H. Stevens, Detroit, Mich.

CINCINNATI RADIOLOGICAL SOCIETY

The radiologists of Cincinnati have recently organized a society which is to be subsidiary to the Cincinnati Academy of Medicine and is to be known as the Radiological Section of the Academy of Medicine of Cincinnati. Membership in the group is limited to those who engage in radiology or roentgenology exclusively and who belong to the Academy. It is planned to hold informal meetings monthly and at least once each year have a radiological program before the entire Academy of Medicine. The officers for the present year are Dr. Samuel Brown, president, and Dr. Harold G. Reineke, secretary.

INDIANA ROENTGEN SOCIETY

The Fifth Annual Meeting of the Indiana Roentgen Society was held in Indianapolis on February 22, 1932. Dr. H. P. Doub of Detroit addressed the Society. The following officers were elected: President-elect: Dr. R. L. Lochry, Indianapolis; Vice-president: Dr. H. W. Sigmond, Crawfordsville; Secretary-Treasurer: Dr. J. N. Collins, Indianapolis.

DEPARTMENT OF TECHNIQUE

Department Editor: Robert B. Taft, 105 Rutledge Ave., Charleston, S. C.

ROENTGEN EXAMINATION OF THE INFANT THORAX*

A PRECISION TECHNIQUE

By DAVID R. BOWEN, M.D.
Pennsylvania Hospital
PHILADELPHIA, PENNSYLVANIA

THIS method, the result of some two years of "cut and try," has been developed for the more precise roentgenography of the chests of new-born infants.

The following claims are made for it:

1. Economy. Film expenditure is cut in half.

2. Comfort. The babies are routinely so comfortable and sleep so quietly that crying[1] must be induced in order to recognize respiratory phases.

3. Simplicity. All restraint may be applied in the nursery, quite relieving the roentgen department of that detail.

4. Timesaving. At the roentgen-ray table exposures may begin without delay. No examination requiring so many exposures proceeds more rapidly.

5. Precision is the cardinal feature. All postures may be duplicated with a routine uniformity of extreme value for comparison with not only later studies of the same patient but for research with groups of any number.

The method is, however, for infants only. When understanding arrives it seems that some other method will be needed. With simple accessories, we do use the frame for chests of older children to the limit of a full 8″×10″ film.

The restraining harness is a formation of flannelette with a sleeve-like body which fits a poplar board ¼ by 3 by 33 inches. The harness is so designed as to require no hand sewing other than basting, and by the sewing machine only the simplest handicraft is needed. To the sleeve-body is fitted first

Fig. 1. Baby in frame, erect lateral posture. Removable tunnel adjustable for height and two exposures per film. Note baby's hands, the comfortable expression and the firm cotton cloth chin rest. Note slip block for chin lift and head fixation.

[1] Crying, not a whimper, but a resounding lusty cry, is absolutely essential if inspiration and expiration phases are to be accurately depicted.

* Read at the Thirty-second Annual Meeting, American Roentgen Ray Society, Atlantic City, N. J., Sept. 22–25, 1931.

a cap with drawstring. The first act of restraint is to tie this about the baby's head. Second, there are three short straps of the same material. Of these the first two are brought forward and downward over the shoulders, while the third is drawn forward and upward over the perineum. Tapes, laced through loops in the free ends of these straps and through loops in a single thickness breast and body guard, serve to hold the child quite firmly, save for the arms and legs.

A 4 yard, 3 inch roller bandage of the same flannelette is run downward over the torso and legs—over the torso so lightly as to offer no restraint to breathing, and over the legs tightly enough to prevent kicking. The toes, left free, give an ever ready index of even the slightest discomfort.

Finally, the arms are drawn forward, then upward and held, fully extended, beside the head. Wider straps, sewn to either edge of the sleeve-body immediately above the shoulders, are then drawn outward over each arm and tied at the back with a lower and a middle tape. The third, top, tape is passed backward and to the front, where it is tied over the hands. Grasping this tape gives the little patient real comfort, and, from this point, quiet sleep is routine. A slip block, 3 by 3 in., with $\frac{1}{4}$ in. holes in the two free corners, is placed on the board above the cap in much the same way as index cards are held in place by adjustable back-rests. Tapes, fast to the upper border of the cap near the temporal areas, are passed through these holes and firmly tied. The head is thus drawn to the proper extension or chin lift and rolling of the head is prevented.

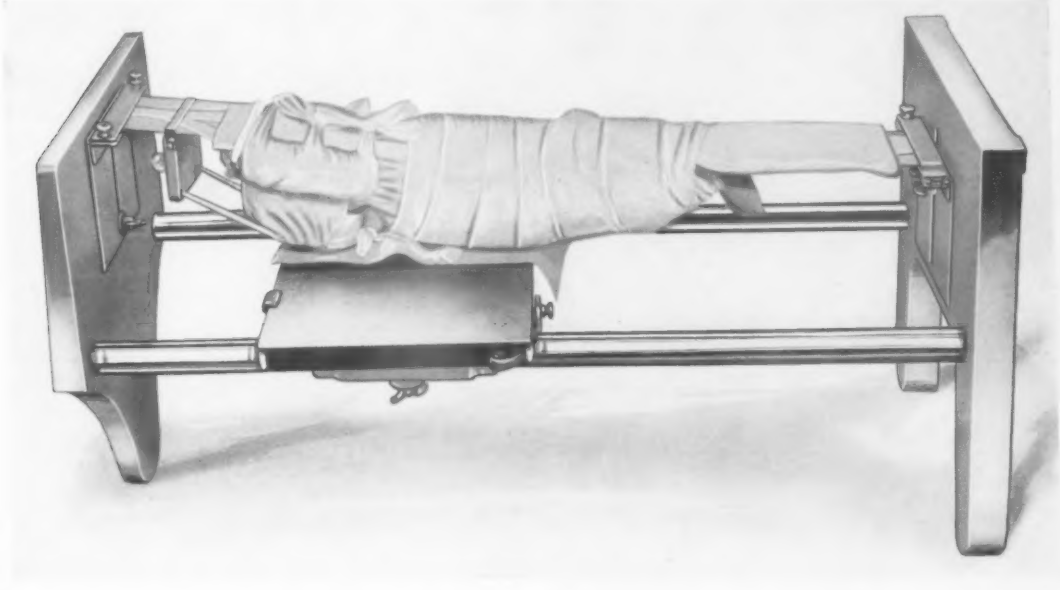

Fig. 2. Prone posture for anteroposterior study. Erect anteroposterior posture is secured by standing frame on end (see Fig. 1) with no change of baby's relation to the frame.

Nurses, as a rule, like to induce crying, when crying is required, by snapping at the toes with their fingers but gentle closure of the nostrils is as quickly effective and to be preferred.

Detailed patterns have been prepared in blue-print form and will be readily understood by any trained seamstress.

It seems to us, after much trial, that at least six exposures are necessary: viz., posteroanterior erect, posteroanterior prone[2]

[2] If thymus only were to be considered the prone position might be omitted. Our experience thus far leads us to suspect that non-expansion is by far the most frequent abnormality found and for this we consider the prone position highly important.

and lateral erect, exposing with inspiration and with expiration in each of the three postures. In all our earlier work the baby was held in the various positions by

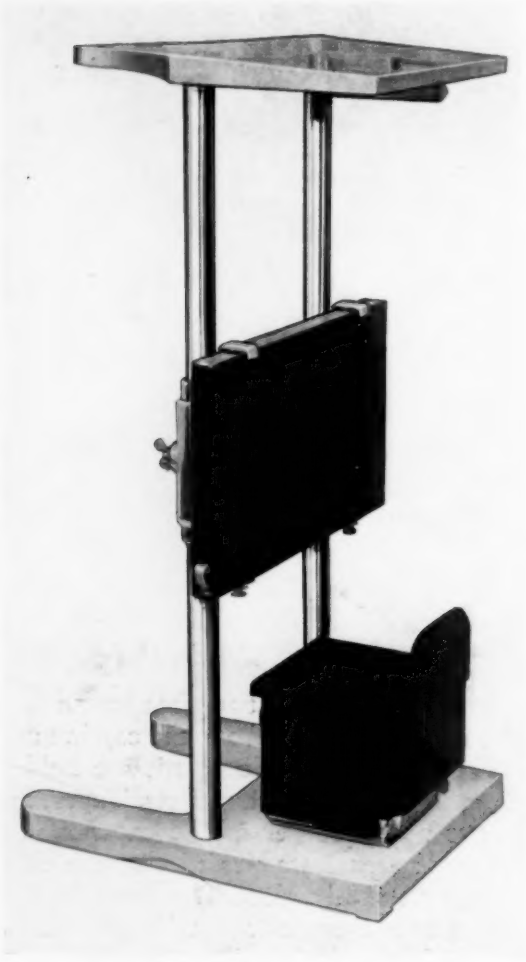

Fig. 3. Tunnel reversed, free bakelite aspect forward, for single 8″x 10″ of older child. Stool fits tightly in lower clamp; hands rest on side rail with elbows akimbo, against the tunnel, held by an efficient binder (not shown).

pupil nurses. It became more and more evident that manual holding would be continuously unsatisfactory. To expose one nurse repeatedly is unthinkable; to instruct a new one for each examination is always to have an unknown factor. Trepidation was always present and a degree of general unadaptability not always absent.

An all-metal frame was then developed which replaced the variability of manual holding with a precision technique which permits an exact uniformity of posture, with two negatives on each film.

A top piece, a base piece and the parts for a cassette tunnel bracket are cast from aluminum. These are assembled upon two lengths of brass pipe. Three legs, two at the bottom and one at the top, are incorporated in the castings so that the frame may be used erect or horizontally. Holders for the poplar board are fitted to top and base by slots and thumb screws so as to be universally movable in one plane. The board is received at the top by adjustable tenon. A similar receptacle at the base can be opened and clamped shut by a thumb screw. These fixtures allow one inch lateral adjustment so that the child may be accurately centered even if its fixation to the board is off center.

The cassette tunnel used here is of somewhat unusual construction. A strip of brass $\frac{1}{4}$ in. thick and $\frac{3}{4}$ in. wide is bent to U-shape, with sharply square corners inside. This is drilled and tapped for flathead screws which serve to fit, to both front and back, sheets of $\frac{1}{8}$ in. bakelite.

To the front two brass plate protectors are fitted, permitting the exposure of alternating ends of the film. The other side is left uncovered and, by a suitable carrier, permits exposure of the whole film in a required position, when older children are examined. For these an accessory stool and binder are required.

Certain cassettes vary greatly from the average in length and width. If such are needed the width and length of the tunnel must be increased to fit the desired model.

At this time no attempt will be made to arrive at clinical values. A research study of a sufficient number of consecutively born babies is planned during the coming year. To this date examinations have been limited to such new-born infants as have seemed to present abnormal signs clinically.

In the larger number of cases thymic disorder was suspected but in only two cases

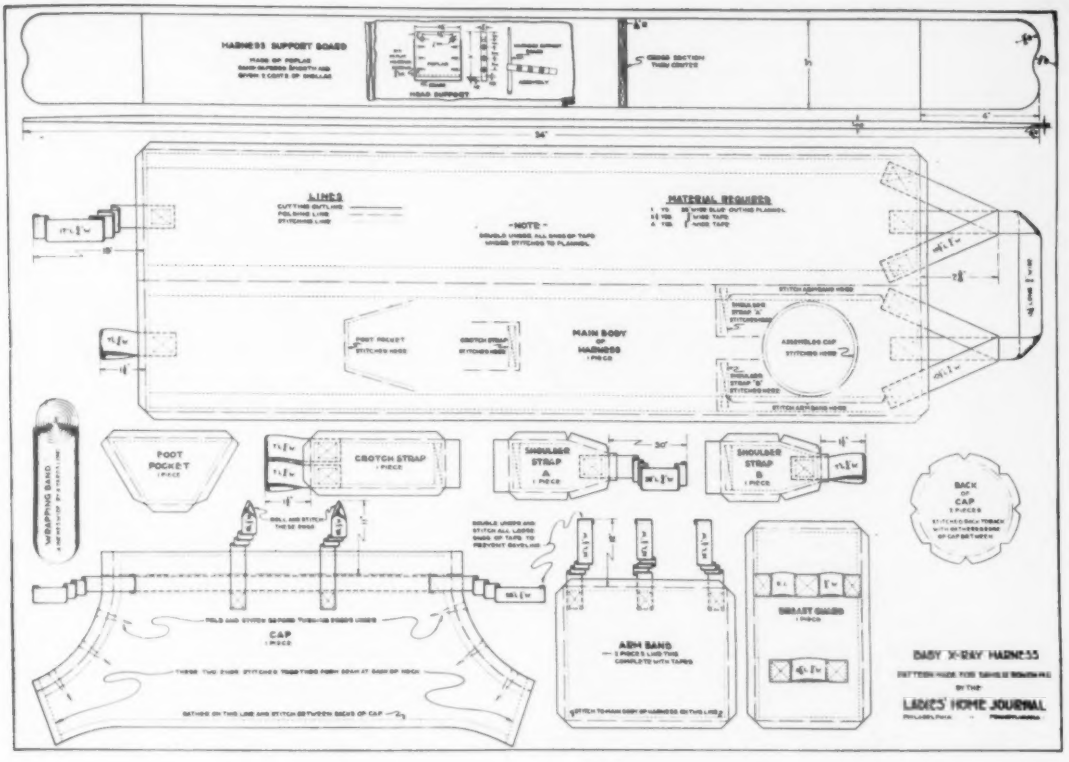

FIG. 4. Reduction of pattern sheet for cloth harness.

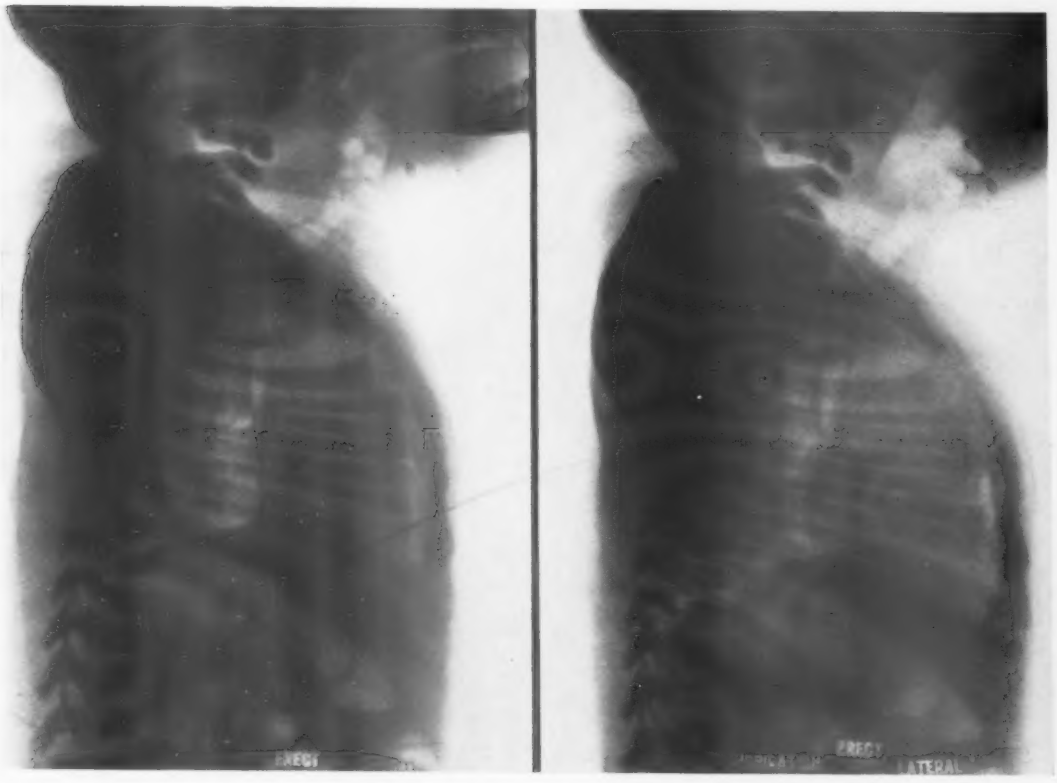

FIG. 5. Lateral erect posture; shoulder shadows far from that of trachea. Chin held level with mandibular angles.

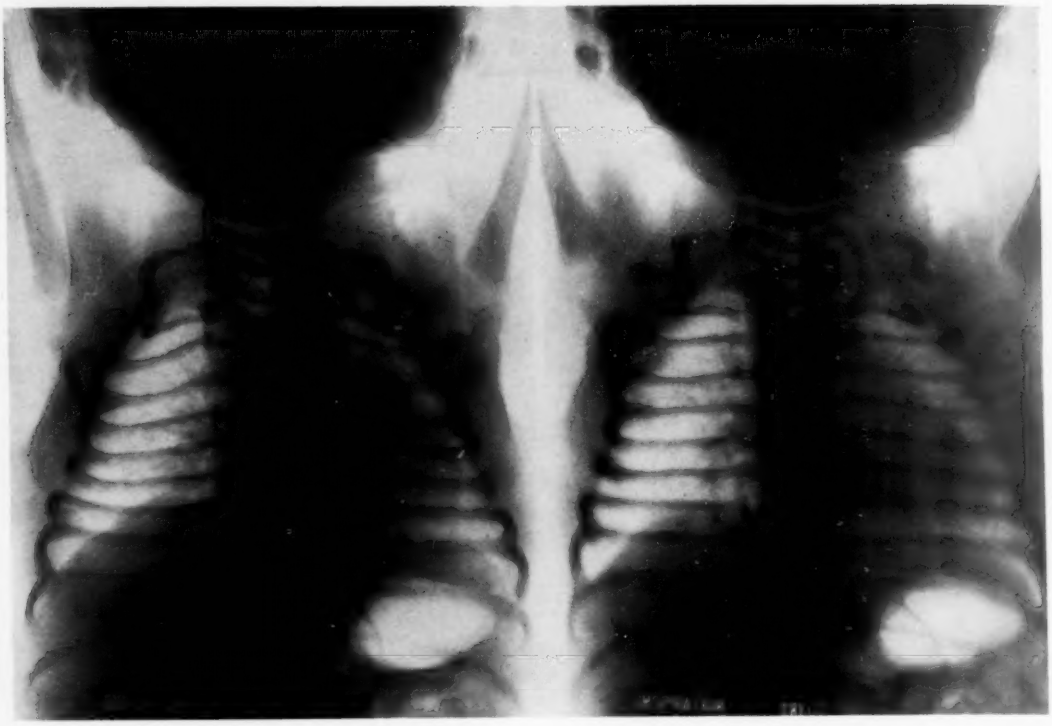

Fig. 6. Erect anteroposterior position. Minor non-expansion upper left, inspiration and expiration.

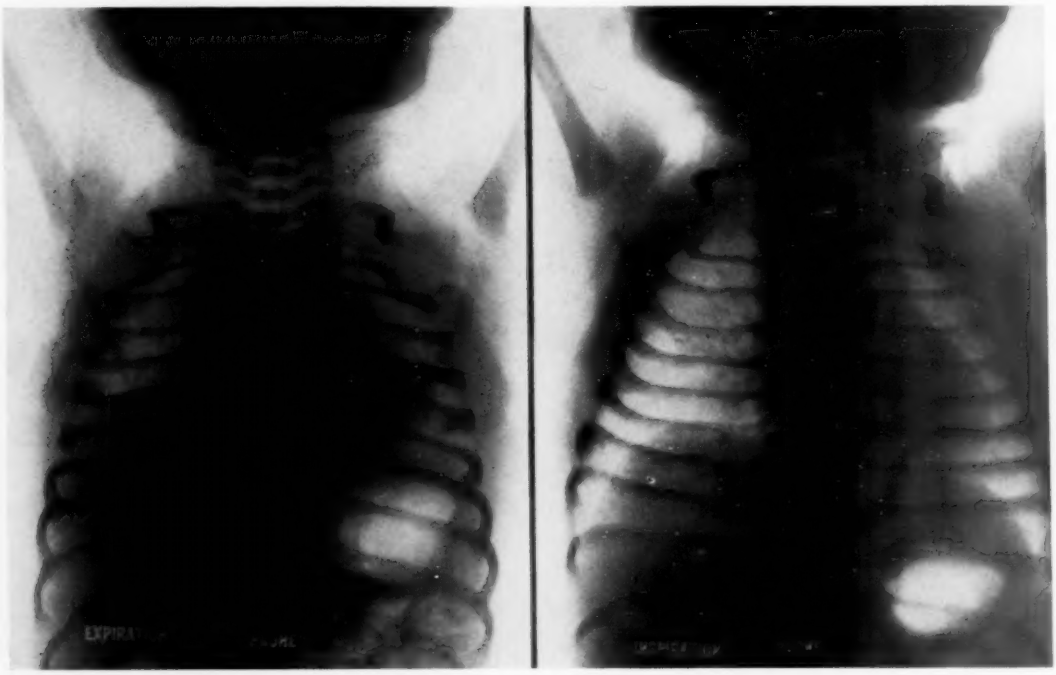

Fig. 7. Same as Figures 5 and 6. Note tendency to right non-expansion, better shown prone than erect.

was this condition even remotely suggested by roentgenograms. Non-expansion[3] of the lungs has been the most frequently observed entity. In just what degree and at what age this condition should be accepted as pathologic is one of the problems opened for solution by this equipment. Presumably, like massive atelectasis in the adult, it will prove benign or pathologic according to the presence or absence of infection.

There have been two cases of pneumothorax without, in either, the discovery of fractured ribs. In both the existence of pneumothorax was unsuspected and in both the recovery was uneventful.

Dilatation of the esophagus with air in other cases seems sufficient to cause respiratory embarrassment.

Among other conditions noted have been narrowing of the trachea, irregularity of phrenic excursion, fractures and, in one case, there was a knot in the umbilical cord and a marked enlargement of the heart.

In all, a very fertile field seems open for satisfactory investigation. While we wish to approach this in an unbiased manner, we must admit that we would not be surprised if it should be established that babies and young children may die suddenly, even under anesthetics, from other than thymic causes.

To Miss Selena Black, R. N., of our X-ray Department, and to Mr. William Winters, chief engineer of the Pennsylvania Hospital, I am indebted for patient cooperation and much constructive work. To Mrs. Bowen I owe most of the sewing machine planning and to the Ladies' Home Journal, the translation of this into working patterns.

DISCUSSION

Dr. Ramsey Spillman, New York City. One of our New York colleagues not long ago made a comment on babies that I am sure evoked an echo in the heart of everybody at the New York Roentgen Society, when he said, "I am devoted to babies in the home, but my heart sinks when one comes into the laboratory." I believe Dr. Bowen's device will take a great deal of that sinking of the heart out of the roentgenologist's breast and enable us to get better films than we have heretofore.

Dr. Belden, whose genial presence is sadly missed at this meeting, was examining thymuses in the upright lateral position before Dr. Pancoast and Dr. Pendergrass came to New York a couple of years ago, so that method of examination was not altogether unknown to us. Their paper and the technique which they demonstrated before the Pediatrics Section of the Academy of Medicine produced, in at least the circles in which I am acquainted, quite a change in the technique of thymus examinations and in the conclusions drawn from the examinations. I have no patience at all with the practice of taking a good idea and modifying it until the original excellence is lost in a maze of "improvements." But I saw the need of something like their chair, and I had one constructed immediately, and I would not have modified it at all had it not been that my x-ray room is too small to use a chair as large as the original one. I therefore made some changes in the design which did not alter the principles. Now I believe that for very young babies, Dr. Bowen's device goes the ingenious chair of Drs. Pancoast and Pendergrass even one better. I hope that it will be commercially available very soon, because the temptation is very strong to go ahead and try to make a home-made version of it, and certainly we shall very shortly be needing it. So I urge Dr. Bowen to get the manufacturers busy on it, and I hope it will not be too expensive for some of us younger men when it comes on the market.

Dr. Henry K. Pancoast, Philadelphia. I have been much interested in the development of Dr. Bowen's technique for the last two or three years in an attempt to get the child in the proper position for the two necessary views. He has accomplished something that is most essential in the lateral view in a way in which it could be brought about by no other method. The most serious objection to having the arms raised above the head in the lateral view is that the shoulders obstruct the upper respiratory tract which is often the most important part of the tract to examine. By Dr. Bowen's method, the upper respiratory tract is entirely clear.

[3] This wording, suggested by Dr. Bishop, is distinctly to be preferred to atelectasis. This lung has not collapsed; it has never well opened.

Another point that one must be very careful about is to get the chin sufficiently high. There are one or two of Dr. Bowen's films in his exhibit in which the head has dropped just a little too much and causes a buckle in the trachea which is the result of faulty position and not pathology. We must be able to recognize pathological buckling.

Dr. Bowen has called your attention to another essential part of the technique and that is to have the child crying. It must be crying regularly and lustily and not in a catchy manner. If the child is sobbing, you will get most erroneous results.

Every one has his own method of making a child cry. Ours is to tickle the ribs or the soles of the feet. He holds the nose.

Dr. Bowen (closing). I realize Dr. Pancoast's criticism of the position. Those films were selected rather hurriedly in my absence, simply to show the method. The one where the chin drops was before we adopted that head block. Now we put the chin where we want it and it stays there.

A SAFE FOR RADIUM

By IRA I. KAPLAN, B.S., M.D.
Radiation Therapist, Bellevue Hospital
Director, Division of Cancer, Department of Hospitals
NEW YORK CITY

BEFORE 1928, Bellevue Hospital, the largest free hospital in the City of New York, owned no radium, and radiation therapy, when radium irradiation was indicated, was carried out by means of radon applicators, the radon being purchased from commercial makers when and as needed. In April, 1928, a gram of radium was bought by the City and turned over to the Radiation Department of Bellevue for carrying on its work. This radium was in the form of needles and tubes.

Upon the acquisition of this very valuable quantity of radium, there arose the most important problem of how to protect it from loss, at the same time keeping it readily available for immediate use in the daily service of the hospital and clinic.

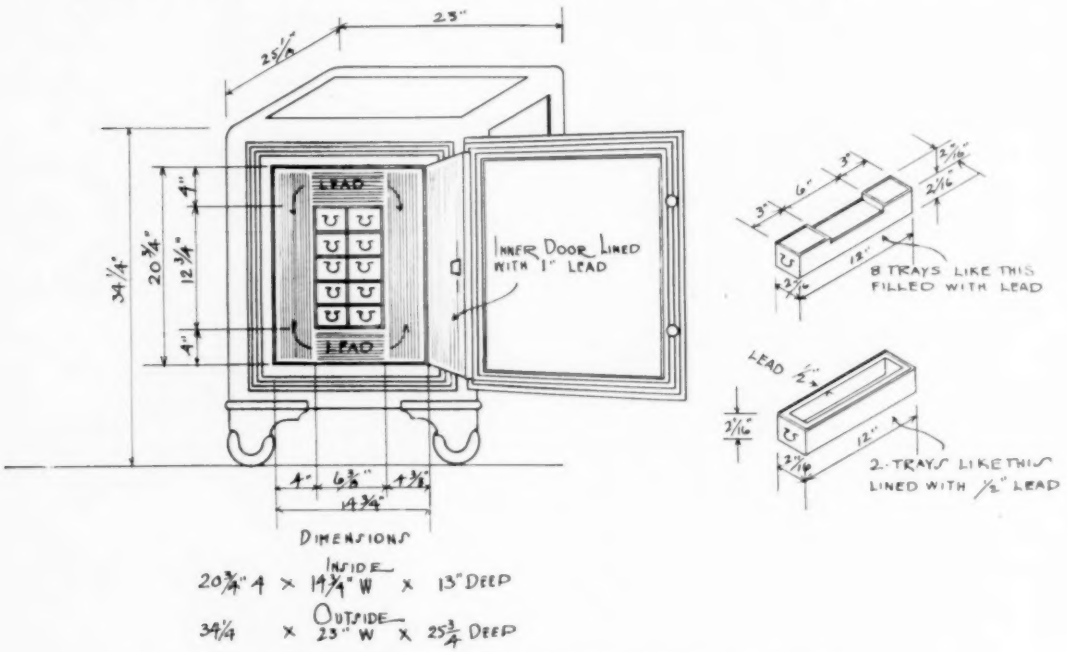

FIG. 1. Showing special lead lining of safe, door, and drawers.

When only radon applicators were used, care was against loss solely to the container, if it happened to be of platinum or gold, as the radon itself, while biologically as effective as radium, deteriorates rapidly and in a few days becomes valueless. Radium, on the other hand, is a costly element, whose action continues for centuries, and therefore its loss would be a serious matter. On account of its high cost radium must be carefully guarded against loss, and furthermore because of its constant radiation action, it must be so stored away that no destructive effects from its emitted rays are able to reach the personnel concerned with its therapeutic use.

Bearing in mind these factors and also that, as shown by science, lead is the best insulator against radium rays, there was devised a lead-lined safe, so constructed as to safeguard the radium from loss or theft and protect the personnel. In order to have the several types of applicators readily accessible and separate from one another, individual drawers were constructed for the various kinds of tubes and needles. Furthermore, in order that the contents of each drawer might be seen at a glance and to facilitate a check-up of the applicators the drawers, lined with a block of solid lead were drilled with holes for each individual applicator, either needle or tube. Accordingly, a vacant hole in the lead indicates that an applicator is missing from the safe.

The lead in each drawer is so cast as to give a 4 inch lead screen protection for the fingers. Two of the drawers are hollow lead boxes for long applicators such as the new type breast needle. The door of the safe is also lined with lead, as an added protection to the one who unlocks it.

The various details of the safe, which weighs 3 tons, are displayed in Figure 1, which shows the lead protective lining cast in the body of the safe, the separate drawers with their lead linings and the box drawers. We have now had constructed three such safes, following the successful employment, since 1928, of the first one in the radiation department of Bellevue Hospital.

Our thanks are due to Messrs. A. L. Miller and George Loftus of the Radium Chemical Company, George T. Taylor of the Radon Co., Inc, and to the engineers of the Mosler Safe Company, who very ably cooperated in carrying out our ideas in the successful construction of a radium safe that fulfills all the requirements of safety and accessibility.

BOOK REVIEWS

Books Received Are Acknowledged under Heading: Books Received. This must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers as space permits.

Lehrbuch der Röntgendiagnostik. Von H. R. Schinz, W. Baensch and E. Friedl. Nebst Beitragen von M. Holzmann, A. Hotz, O. Jüngling, E. Liebmann, E. Looser, K. Ulrich. Two volumes. Third, enlarged edition, Price, paper, M. 214; bound, M. 220. Pp. 1623, with 2714 illustrations in the text and 5 photographic plates. Leipzig: Georg Thieme, 1932.

This textbook on Roentgen Diagnosis, which has just been published in the third edition, is a monumental piece of work. The first edition was published in 1928 and consisted of 1131 pages of text and 1722 illuminating illustrations. This book was so highly appreciated by the profession, and the demand was so great, that the first edition was exhausted in five months.

The advanced knowledge now available has demanded from the authors an increase to 1623 pages of text and this text is illustrated by 2714 figures and 5 photographic plates. It has therefore required two volumes. The first volume portrays the roentgen evidence obtainable in all phases of diseases, injuries and anomalies affecting the skeleton. It is, therefore, most valuable in surgical diagnosis, and of special interest to roentgenologists, surgeons and surgical specialists.

The second volume portrays the normal and the pathological conditions of the internal organs in a very elaborate manner. It is not merely a textbook but also an atlas. Space is not occupied by descriptions of apparatus or technique. Each chapter is followed by a bibliography which will enable the reader to make further investigation of any special point.

As a whole, this third edition in two volumes is the most complete textbook on general roentgen diagnosis published to date. Every roentgenologist, every medical library, and even the surgeons and physicians who are aiming to keep abreast of medical diagnosis should possess this work.

It is written in German and therefore will be most appreciated by those who can read this language, but the illustrations are so well reproduced, and so well explained by diagrams and legends that even those who have only a meager knowledge of German can obtain a great fund of information. The authors and the publisher are to be congratulated upon this excellent production.

George E. Pfahler

Röntgenuntersuchungen am innenrelief des Verdauungskanals. Ein Beitrag zur klinischen Röntgendiagnostik insbesondere von Entzündung, Geschwür und Krebs. Von Professor Dr. Hans Heinrich Berg, Chefarzt der medizinischen Klinik der städtischen Krankenanstalten in Dortmund. Second, enlarged edition. Paper, price, M. 30; bound M. 32. Pp. 248, with 247 illustrations. Leipzig: Georg Thieme, 1931.

The second edition of Berg's book presents essentially the same material as in the first with considerable expansion of certain sections, especially the discussion of sources of error, the changes involving the esophageal hiatus, the postoperative stomach and the large intestine. The illustrations have been increased from 193 to 247 and include more photographs of pathological specimens. Needless to say, the positive reproductions of the roentgenograms are excellent. The legends are unusually complete and instructive.

The essence of Berg's work is the study of the inner surface relief contours of the digestive tract. To bring out these inner surface shadows, he makes exposures of small sections under "controlled pressure" after giving the proper quantity of opaque suspension. The ideal apparatus for this purpose has not yet been produced, especially as applied to the stomach and duodenum, which are the principal concern of the method. The production of satisfactory films is not easy and takes time. Their interpretation requires experience. There are many pitfalls which Berg discusses at length. He recommends that the relief contour study be followed by complete filling of the stomach and the customary examination.

The remarks made in the review of the first edition (American Journal of Roentgenology and Radium Therapy, 1930, *23*, 430)

apply to this one also. Berg has set an example of careful accurate observation of small details. His book is interesting and stimulating and should be translated into English.

Ross Golden

Röntgendiagnostik der Gallenblase. (Radiologische Praktika, Band XVII.) Von Priv.-Doz. Dr. F. Eisler und Dr. G. Kopstein. Cloth. Price, M. 18.60. Pp. 153, with 151 illustrations. Leipzig: Georg Thieme, 1931.

If one reads only enough German to decipher the descriptive matter beneath the illustrations in this book it will be found very worth while. The illustrations are many and varied and cover well the field of cholecystography. They include serial films on the same case showing the effect of change of position, cleansing enemas, fat meal and other factors which enter into the making and interpretation of roentgenograms. The relation of the gall-bladder to the stomach, duodenum and colon is also frequently demonstrated. Calculi of numerous bizarre shapes are shown and differentiated from glands, concretions, calcified gall-bladder walls and other extraneous shadows. The differentiation of pseudo-gallbladder shadows from the true shadow is discussed.

Brief anatomical and physiological studies are included to serve as a basis for the deductions and explanations of phenomena.

In the section on technique four methods of administration are considered, viz., the intravenous, the oral, the intraduodenal and the rectal. The authors prefer the oral method and have had great success with capsules. They also prefer a light "no-fat" evening meal on the day preceding the examination.

They speak from considerable experience, having conducted nearly ten thousand cholecystographic studies of which about one thousand cases were checked by autopsy or operation.

E. W. Hall

Die Dickdarmschleimhaus, ihre normale und pathologische Funktion im Röntgenbilde. Von Priv.-Doz. Dr. Werner Knothe, Leiter der Röntgenabteilung der II. medizinischen Universitätsklinik der Charité, Berlin (Direktor: Prof. G. v. Bergmann). Cardboard. Price, M. 8.00. Pp. 56, with 113 illustrations. Leipzig: Georg Thieme, 1932.

What roentgenologist has not felt the monotony and drudgery of the routine barium enema? The large number of negative examinations tends to make the examiner careless and to discourage the clinician who feels that he should have some explanation for symptoms of which his patient complains. Dr. Knothe's work should add new zest to the study of the colon. His discussion of the mucosal folds of the large intestine and the many accompanying illustrations are interesting and instructive.

Proper preparation for barium enemas is essential. Cathartics are used only in cases of chronic obstipation since they tend to change the mucosal patterns usually present, but cleansing enemas and reduced diet are necessary preliminaries. Observation of the colon includes both filling and emptying phases with detailed roentgenograms of interesting areas, but the insufflation of the colon with air is not given much attention by the author—probably because distention would interfere with mucosal relief.

The author discusses the types of mucosal relief in normal colons, this being different in the hypermotile and quiet types. Then follows a description of the effects of irritation by drugs or reflex disturbances such as duodenal ulcer or prostatitis.

True colitis can be definitely differentiated from irritable colon only by roentgenologic study, but this method gives a very exact differential diagnosis. Three stages of colitis are recognized, the first showing mucosal changes incident to swelling from acute congestion and edema, the second showing finer folds with a hyperplastic process, the third showing evidence of chronicity with involvement of other layers of the colonic wall. The degree of colitis as shown roentgenographically has much influence on the prognosis and treatment.

Other colonic conditions as demonstrated in mucosal relief are tuberculosis, diverticulosis, and tumors, each of which is discussed.

The book is recommended to all roentgenologists.

E. W. Hall

Surgery of the Chest. By George F. Straub, M.D., F.A.C.S., The Clinic, Honolulu. Cloth. Price, $10.50. Pp. 475, with 341 illustrations, including 68 color plates. Springfield, Ill., and Baltimore, Md.: Charles C. Thomas, 1932.

The author's stated aim in writing this book was to stimulate interest in thoracic surgery, to present in a highly practical way a short, concise, clear and complete treatise. The forty chapters cover all expected subjects. There is a surprisingly great number of drawings of excellent quality, most of them being the work of the author. Especially valuable chapters on Physiology of Respiration and Pathological Physiology of the Thorax have been contributed by H. L. Arnold.

The author has obviously labored greatly and enthusiastically with his task and the publishers have produced a handsome volume. The book is a storehouse of information, splendidly indexed, that the general practitioner and the thoracic surgeon alike will find interesting and useful for systematic reading or for reference.

As there have been relatively few recent English monographs dealing with thoracic surgical subjects, publication of a book covering the entire field is an event of great interest to a large number of prospective medical student and physician readers. The value of such a work should, therefore, be especially critically judged.

This reviewer cannot recommend the book for the guidance of those medical students or physicians who seek an authoritative presentation of the best modern thoracic surgical practice. He finds in the book an insufficiently critical judgment in evaluating methods and procedures. He considers as unnecessarily dangerous a number of operations and methods of treatment which the author advocates in such commonly met conditions as acute and chronic empyema, injuries of the thorax, bronchiectasis and pulmonary tuberculosis, which operations were in vogue chiefly in Germany some years ago and which perhaps may still be in occasional use there and elsewhere.

Straub writes that intercostal drainage of an empyema is justified only for patients whose general condition will not permit of rib resection and "Thus thoractomy *with* resection of a rib is to be considered the standard operation in the treatment of acute empyema." No mention whatever is made of the epoch-making and now already classical work of Graham and Bell and the Empyema Commission of the U. S. Army. Straub recommends for many uncomplicated cases of acute empyema, resection under differential pressure of 6–8 cm. of two or three ribs, their intervening intercostal bundles and underlying parietal pleura, exploration of the pleural cavity, removal of fibrin, pus, etc., gauze packing of the empyema, covering the wound with an "air-tight" dressing of rubber dam or cellusilk pasted on the skin with zinc paste or mastic solution. In the reviewer's opinion this operation is dangerously and unnecessarily radical. With regard to chronic empyema, no mention is made of the outstanding and well-known work of Colonel William Keller.

Radical surgery for civil life thoracic injuries is stressed rather than the conservatism that the experience of many has shown is safer for the patient. Stress is not laid upon the almost indispensable continuous needle and water-seal evacuation of a tension pneumothorax. The statement is made that the only remedy for a reopened sutured bronchus is revision of the pedicle and repair. As reopening of such a bronchus is usually due to infection, such a repair would be useless.

Few experienced thoracic surgeons will agree with the statement that the present day tendency in the surgical treatment of bronchiectasis is performance of an extensive paravertebral thoracoplasty six to eight weeks after ligation of the pulmonary artery of the diseased lobe or lung.

In discussing thoracoplasty for tuberculosis, a position is illustrated for operation on an orthopneic patient, and unilateral or bilateral crushing or injection of the phrenic nerve is stated as giving only temporary relief from postoperative hiccup. The reader must assume that the author considers that a thoracoplasty might be permissible on an orthopneic patient or that total paralysis of both sides of the diaphragm is justifiable in a patient with an accomplished thoracoplasty. Favorable attention is given to Ostermeyer's mobilization of the entire shoulder as a means of approach for thoracoplasty, which to the reviewer seems shockingly and unnecessarily radical. Straub states that under favorable circumstances, thoracoplasty patients should be out of bed in a wheel chair one week after operation and be up and about after two or three weeks. This statement appears to demonstrate ignorance of the vital importance of conserving all of the energies of such a postoperative far-advanced tuberculous patient by insisting upon strict bed rest under sanatorium régime for an absolute minimum of three months after operation.

The nine-page chapter devoted to the important subject of Acute and Chronic Suppuration of the Lung and the seven-page chapter to Bronchiectasis are quite inadequate in length, content and value. By contrast forty pages are devoted to the Surgery of the Heart and the Pericardium.

The sections devoted to pulmonary tuberculosis fairly represent good practice of from three to five years ago but great forward strides have been made during these few years. Instead of only 20 per cent of all patients being suitable subjects for artificial pneumothorax or some of the various surgical procedures now in use, from 50 to 70 per cent are today considered suitable by some of those clinics in which an especially great interest in the subject is being taken. Straub appears closely to follow the teaching of the Sauerbruch School in favoring a one-stage thoracoplasty, in insisting upon resection of the lower ribs first when a two-stage operation is used, in denying the efficacy of phrenic nerve interruption as an independent operation in a considerable group of patients, all of which teaching many widely experienced thoracic surgeons today consider unsound. Straub declares that exeresis is the only phrenic operation that guarantees lasting phrenic paralysis, which is obviously untrue. Straub writes that a thoracoplasty should be stopped if during its progress the blood pressure should drop 10 mm. of mercury; if this advice were followed a great many thoracoplasties would be interrupted without sufficient reason.

The book is dated January 1, 1932, and yet in its eight-and-a-half-page bibliography there are no references for 1931, only eight for 1930 and twenty-six for 1929 (unless a few undated references should increase these figures). There are a great many important omissions, notably the 1928 and 1930 volumes of the second edition of Sauerbruch's "Chirurgie der Brustorgane," the epoch-making work of Estell Lee, Coryllos and Birnbaum and others on pulmonary atelectasis and the reports of Harrington on diaphragmatic hernia and thoracic tumors.

As adverse a criticism as this requires, in fairness, a number of examples of what is adversely criticised, and this is the reviewer's apology for the length of this note.

John Alexander

Électricité et radiologie médicales. Par Dr. Leon Gally, Radiologiste des hôpitaux de Paris, et Dr. Pierre Rousseau, Ancien interne des hôpitaux de Paris, Chef du laboratoire d'Électrologie a la Faculté de Médicine de Paris. Paper. Price. 10 fr 50. Pp. 220, with 56 illustrations. Paris: Librairie Armand Colin, 1931.

This little book in "vest pocket size" was written for the layman and medical student as an introduction to the field of medical electricity and radiology. Its style of writing is of necessity somewhat popular and the physician specializing in radiology will hardly find new ideas in the text. The first part edited by P. Rousseau covers all phases of medical electricity, including the physical principles, the use of galvanic and faradic currents, ionization, high frequency and diathermy, as well as a chapter on electrodiagnosis. In the second part, L. Gally, in collaboration with two of his assistants, gives a complete, though brief, account of the application of roentgen rays in diagnosis and treatment. Several diagrams showing circuits of apparatus and also a number of photographs of installations in Paris hospitals are appended.

Ernst A. Pohle

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ABSTRACTS OF ROENTGEN AND RADIUM LITERATURE

ROENTGEN DIAGNOSIS

HEAD

Sighinolfi, Piero, and Viola, Carolina. La nostra esperienza su l'encefalografia in alcune malattie del sistema nervosa del bambino. (Experience with encephalography in diseases of the nervous system in children.) *Radiol. med.*, Dec., 1930, *17*, 1432–1456.

Ten cases of different diseases of the nervous system in which encephalography was used are described and illustrated with roentgenograms. There were no cases of immediate death though most of these patients were in extremely serious condition; but the method does involve considerable shock and may have the effect of making a patient worse if he is already in serious condition. In two cases of tuberculous meningitis in which it was hoped that the encephalography would have some therapeutic effect the results were disappointing. There was no improvement. The ventricles did not fill in a case of tumor of the inferior vermiform process of the cerebellum nor in some other cases of hydrocephalus in which previous inflammation of the meninges had blocked the foramina of Luschka and Magendie. Paraventricular tumors were demonstrated brilliantly.

The authors conclude that in the present status of ventriculography it should be used in only a few cases, at least until it has been rendered less dangerous by changes in technique, such for example as the decrease in the amount of gas used, proposed by Besta.—*Audrey G. Morgan.*

Pendergrass, Eugene P. Indications and contraindications of encephalography and ventriculography. *J. Am. M. Ass.*, Feb. 7, 1931, *96*, 408–411.

Exact localization of brain tumors is of great importance, the mortality from unlocalized tumors being 100 per cent. A very large percentage of pituitary cerebral and cerebellar tumors can be localized roentgenographically, especially when ventriculography and encephalography are employed. Proper technique of ventriculography requires that all of the fluid be withdrawn from the ventricles and replaced by air, films being made within one hour. Roentgenograms should be made with the tube below the head and the film and Potter-Bucky diaphragm above the head to bring the maximum amount of air next to the film. Good films must be secured with the head held carefully in proper position.

In encephalography all available cerebrospinal fluid is removed and roentgenograms made in the vertical position.

Ventriculography completely outlines the ventricular system, localizing tumors, abscesses and blocks, but it requires two trephines, may cause hemorrhage by puncturing a tumor, may cause reactions with mortality and may not show the subarachnoid space.

Encephalography is simple, has little mortality, visualizes all the fluid pathways, visualizes surface lesions, relieves post-traumatic headache, but it causes severe headache and nausea, is contraindicated in posterior fossa tumors and demonstrates the ventricular horns rather poorly.

Both methods may be necessary in the same case.—*E. W. Hall.*

Gotten, Nicholas. The incidence of brain tumors in epilepsy, as revealed by routine encephalography. *J. Am. M. Ass.*, Apr. 4, 1931, *96*, 1118–1121.

Routine encephalographic study of 56 cases of epilepsy revealed 3 cases of brain tumor, which are reported in detail. When properly undertaken, with regard to contraindications and technique, encephalography is attended with little risk. The positive cases in which signs of intracranial pressure develop are given symptomatic and clinical relief and justify the routine use of the procedure in cases of epilepsy.—*E. W. Hall.*

Deery, Edwin M. A method of ventriculography. *Bull. Neurol. Inst. N. York*, June, 1931, *1*, 193–210.

The author states that there are three definite causes for failure of ventriculography: (1) due to incomplete filling of the ventricular system with air; (2) due to disagreement between clinical and roentgenographic data; (3)

due to non-retention of air by a small group of cases. The reason for the non-retention has not been determined.

The author then suggests a method of ventriculography, giving the steps of the surgical procedure in detail. This method, the author believes, will reduce the number of failures and will furnish some valuable data in those cases which do not retain air.—*A. S. Kabakjian.*

Masson, Clement B. The occurrence of calcification in gliomas. *Bull. Neurol. Inst. N. York*, June, 1931, *1*, 314–327.

The author reports 131 cases of gliomas verified by operation or necropsy. Seventeen, or 12.97 per cent, of these showed roentgen evidence of calcification. The pathological report on these tumors was as follows:

Number	Kind	Number Calcified
29	astrocytomas	6
30	spongioblastomas	6
25	medulloblastomas	3
1	astroblastoma	1
1	oligodendroglioma	1
31	gliomatous cysts	0
3	tuberosclerosis	0
11	unclassified gliomas	0

Astrocytomas usually contain some spongioblasts and spongioblastomas contain some astrocytes. Thus it can be readily seen that the above findings do not necessarily indicate the age of a tumor. The calcification in a spongioblastoma may occur in an area of longstanding, containing astrocytes. Other writers have reported the following: Dandy and Neuer, 100 brain neoplasms with 6 cases calcified. Only one of these was a glioma. The others were: osteosarcoma, aneurysm, hypophyseal tumor, craniopharyngeal pouch tumor, and a sarcoma of the optic chiasm. Crouse reports only 3 per cent calcification in brain tumors. Camp reports 781 cases of brain tumor with but 7.6 per cent of the cases showing calcification on the roentgenogram. There were 308 gliomas in this series with only 5 per cent calcified. Sosman reports 11 per cent gliomas calcified. Van Dessel reports 13.5 per cent of gliomas showing calcification.

Further advance in the roentgenographic technique should increase the percentage showing calcification to 25.

As yet, the character of calcification does not permit the roentgenologist to definitely state the type of glioma that is present.

Pituitary tumors and tumors of the craniopharyngeal pouch have not been considered because the location of the growth and the arrangement of the calcified areas in this kind of lesion are very characteristic, and present a separate problem from the one being considered.

Obviously, the presence of calcium salts makes the roentgenographic localization of these tumors simpler. The lime salts are usually present in the center of the tumor but may also be found in the periphery.—*A. S. Kabakjian.*

Laschi, Gino. Un caso di "foramen dorsi sellae." (A case of foramen of the dorsum of the sella.) *Radiol. med.*, June, 1931, *18*, 707–712.

The author describes a very rare anomaly of the sella turcica, that is, a foramen in the dorsum of the sella which was only diagnosed at autopsy. In this case the patient, a woman fifty years of age, happened to have an intracranial tumor also and the roentgen appearance of the sella led to a mistaken diagnosis of tumor of the hypophysis.—*Audrey G. Morgan.*

Foa, Arrigo, and Borsotti, P. C. Ricerche di morfologia radiologica dei seni sfenoidali coi mezzi di contrasto. (Roentgen morphology of the sphenoid sinuses studied with contrast medium.) *Radiol. med.*, Oct., 1930, *17*, 1117–1126.

The authors introduced contrast medium into the sphenoid sinus through the meatus by means of an Jtard sound in 15 fresh anatomical specimens and made roentgen pictures before and after the introduction of the opaque medium, controlling the results by anatomical dissections. When catheterization and roentgenography of the sphenoid sinus are successful it shows whether there is or is not a sinus cavity, the form and extent of the cavity, whether it has any prolongations and the topography and relation of these prolongations to the foramina at the base.—*Audrey G. Morgan.*

NECK AND CHEST

Benassi, E. Sull'esofagospasmo essenziale permanente nei bambino. (Essential permanent esophagospasm in children.) *Radiol. med.*, Nov., 1930, *17*, 1334–1345.

Permanent spasm of the esophagus is extremely rare in children. The author describes two typical cases which he saw in little girls, one six years of age and the other seven. In both the site of the spasm was at the diaphragmatic constriction of the esophagus; in all probability the condition was due to nervous hys-

terical causes. This was shown by the satisfactory results of treatment with bromide and belladonna, associated with appropriate suggestive treatment. Roentgenograms of the cases are given which show a peculiar appearance caused by the projection of the mucous membrane contracted by the spasm into the lumen of the esophagus; this is similar to the projection of the pyloric mucous membrane at the base of the duodenum, described by Busi.—*Audrey G. Morgan.*

Vinson, Porter P. Cicatricial (benign) stricture of the oesophagus of unknown origin. *Surg., Gynec. & Obst.*, May, 1931, *52*, 955–957.

After all the known causes of benign stricture of the esophagus have been enumerated, there remains a group of cases in which there is no apparent etiological factor. In 243 cases of benign stricture, 40 were without demonstrable cause. In more than half the cases the location is in the lower third of the esophagus. The chief symptom is dysphagia, but pain and regurgitation of blood may be present. The history may suggest malignancy, and absolute diagnosis may be difficult. Roentgenoscopic examination may give negative results or suggest other lesions than benign stricture. Dilatation is advocated.—*G. R. Miller.*

Kennedy, Roger L. J., and New, G. B. Chronic stridor in childhood sometimes erroneously attributed to enlargement of the thymus. *J. Am. M. Ass.*, Apr. 18, 1931, *96*, 1286–1289.

The enlarged thymus has been given much too important a place as a cause of chronic stridor, hoarseness, cyanosis and choking spells. Thirteen representative cases which had on admission a diagnosis of thymic enlargement were studied. The final diagnosis of these cases included no case of thymic hypertrophy and but one case of thymic tumor. The most common cause of the symptoms was congenital relaxation of the larynx. All had had roentgen therapy prior to admission.

Thymic enlargement can seldom, if ever, be established as a cause of death. Preoperative irradiation of the thymus has been unnecessary in the author's experience.—*E. W. Hall.*

Bromer, Ralph S. The chest in rachitic children; a roentgenologic study. *J. Am. M. Ass.*, Feb. 14, 1931, *96*, 509–513.

A group of 31 mild cases showed only a moderate rachitic rosary. Though admitted to the hospital with a diagnosis of acute bronchitis and pneumonia, none showed a pneumonic process. No deaths in this group were attributable to rickets.

A second group of 24 cases showed a rosary accompanied by roentgenographic and clinical evidence of pneumonia. The mortality rate, 5 deaths in 24, was no higher than in nonrachitic children.

A third group of 23 negroes included children with a marked rosary, and marked chest deformity due to rickets. The mortality in this group was 52.1 per cent. The increase in mortality is attributed to the deformity and lack of rigidity of the chest wall which contribute to poor aeration of the lungs.

The rachitic rosary is round and the rib ends smoothly cupped as contrasted with the angular appearance of the rib ends seen in scurvy. When the ribs are softened and the chest less rigid there is a thinned out and streaked appearance of the ribs. The atelectatic areas in rachitic lungs cannot be distinguished roentgenographically from bronchopneumonia and the prognosis is equally poor.—*E. W. Hall.*

Lambranzi, Mario. Aspetto radiologico particolare nelle forme di tubercolosi polmonare associate con quelle chirurgiche. (Roentgen appearance of forms of pulmonary tuberculosis associated with surgical tuberculosis.) *Radiol. med.*, Oct., 1930, *17*, 1183–1188.

The author describes a special roentgen picture of pulmonary tuberculosis which he saw in subjects with surgical tuberculosis. Clinically this form of tuberculosis was closely related to the fibro-granular tuberculosis described by Bernard and Seyé and to Bard's discrete granular tuberculosis. Roentgen pictures are given showing the large miliary granules, much larger than those of acute miliary tuberculosis which are sometimes so small as to be scarcely visible. Associated surgical lesions generally bring about a typical fibrous condition in the lungs which usually has a very long course and does not show any characteristic symptoms, particularly in the premonitory period.

As to the roentgen appearance in these cases, the author thinks that the formation of small and rather sclerotic nodules was due to the fact that the surgical tuberculosis is a focus of vaccination for the organism which prevents rapid

and violent development of the infection in the lung.—*Audrey G. Morgan.*

Galland, R., and Rautureau, R. Tuberculose pulmonaire diffuse bilatérale a petits éléments avec laryngite tuberculose. (Diffuse, bilateral pulmonary tuberculosis with small discrete lesions associated with tuberculous laryngitis.) *Rev. de la tuberculose*, Jan., 1931, *12*, 25–41.

Galland and Rautureau observed certain aspects of tuberculosis of the lungs in patients suffering with tuberculous laryngitis. The roentgen appearance of the lungs of these patients showed diffuse lesions, almost entirely bilateral, with no invasion of the bases. The lesions were always localized in the upper portions of the lung fields, occasionally involving only the apices. In time there was marked parenchymal involvement. On auscultation the only signs were fine râles. There was no rise in temperature, as a rule. In spite of treatment, the process usually spread rapidly and death resulted within several months or at the most a few years. Intestinal tuberculosis often developed.

The authors report in detail 9 cases, and excellent roentgenograms are reproduced showing the characteristic lesions. From their study, they conclude that this symmetrical roentgenologic form, usually showing discrete, small lesions at first, with little tendency to softening and caseation, offers a good prognosis only if no extensions to the larynx are found. When such extension occurs, a fatal outcome is almost always certain. Laryngeal complications are always serious, as their statistics prove.

They believe that the roentgen ray has demonstrated that primary tuberculous laryngitis does not exist. The larynx is affected by the lymphatic route, tracheobronchial, mediastinal and cervical glands, rather than by direct infection from the expectoration of a tuberculous patient passing directly over a traumatized larynx. The important roentgen finding is a finely disseminated, granular-like process developing in both apices, with retention of these characteristics throughout the course of the disease.—*R. S. Bromer.*

Russell, Albert E. Dust and pulmonary disease. *J. Am. M. Ass.*, Dec. 6, 1930, *95*, 1714–1717.

Few industries whose workers are exposed to dust represent a single or specific dust. Harmfulness of dust depends on its chemical composition, concentration, size of the particles and length of exposure, as well as upon the physical condition of the worker. Inorganic dusts play the principal rôle in disease production, and the greater portion of all diseases involve the lungs. Coal miners are peculiarly prone to bronchitis granite workers to tuberculosis and iron workers to pneumonia. Although roentgenography gives by far more diagnositic information than any other method, discarding other methods is unwarranted. Early silicosis can be detected by physical examination when the fibrosis is too new to be demonstrable by the roentgen ray. Physical examination may often be necessary in differentiating silicosis from tuberculosis or in determining when this almost universal complication of silicosis develops.— *E. W. Hall.*

Lawson, George B., Jackson, W. P., and Gardner, J. E. Pneumoconiosis in iron miners. *J. Am. M. Ass.*, Apr. 4, 1931, *96*, 1129–1131.

The results of study of 17 cases of air drill operators who were subjected to heavy iron and silica dust are analyzed and reported. The chief symptom is dyspnea, the chief pathologic change, fibrosis. Fibrosis is a late stage of the disease and may first be manifested years after a change of occupation, though the development of secondary fibrosis is usually quite rapid. Cough, sputum and slight hemoptysis are at times present but not constant. But one case showed tubercle bacilli in the sputum.—*E. W. Hall.*

Landau, W. Das Röntgenbild der Staublunge der Steingutarbeiter. (The roentgen appearance of the dust lung in stone workers.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Feb., 1931, *43*, 188–201.

Two hundred and sixty stone workers were examined with regard to pneumoconiosis. The changes observed were divided into three stages by using the classification of Saupe which is as follows: Stage I: general increase in the lung markings producing a dense network of webs with spots of pinhead size and beginning hilus thickening. Stage II: mottled appearance of the lung (sago soup, snow flake, buck shot) with pea-sized spots and marked increase of the hilus shadow with eventual calcareous deposits. Stage III: coarse shadows with numerous nodules scattered throughout.

Of the examined cases, 61 belonged to Stage

II, 21 to Stage III and in 83 there was a negative report. The roentgen findings were not entirely uniform, a combination of the signs of several stages occurring frequently. Likewise it was impossible to draw conclusions from the roentgen appearance as to the type of the dust responsible for the silicosis.—*T. Leucutia.*

Overholt, Richard H. Postoperative pulmonary hypoventilation. *J. Am. M. Ass.*, Nov. 15, 1930, *95*, 1484–1489.

Explanation of postoperative pulmonary complications is usually sought within the lung. Recent experiments tend to focus attention on the abdomen as a causative factor in hypoventilation of the lungs. Roentgen studies before and after operation show a definite decrease in chest volume with diminution of all dimensions, especially the cephalo-caudal, because of elevation of the diaphragm.

Factors investigated in the author's study include change in abdominal pressure due to opening of the peritoneal cavity, general effect of anesthesia and narcotics and the abdominal discomfort and pain incident to deep breathing. The high position of the diaphragm prevents expansion of the lower lobes. The position of the diaphragm being chiefly dependent on the positive pressure in the opened abdomen, the author suggests measures to remedy this condition. Pain, as a causative factor in involuntary splinting of the abdominal muscles and voluntary restriction of breathing, should be controlled by morphine. The benefits of increased aeration more than offset the possibility of harm from diminution of the cough reflex by narcotics.—*E. W. Hall.*

Bagliani, Mario. Diagnosi radiologica delle metastasi carcinomatose del polmone. (Roentgen diagnosis of carcinoma metastases in the lungs.) *Radiol. med.*, Feb., 1931, *18*, 214–245.

Having made a study of 12 cases of cancer metastases in the lungs, the author points out the superiority of the roentgen method in making an early and definite diagnosis of such metastases, their number and sometimes even their nature. He describes the form of the metastases and their site and distribution in the lung fields. Except in carcinomatous lymphangitis, there is no characteristic roentgen picture from which a diagnosis can be made of the nature of the tumor. Nodular metastases are much more frequent than infiltrative ones. In advanced cases infiltrative lesions are often associated with the nodular ones but a form that is infiltrative at first always remains so and no nodules appear. The site of predilection of metastases, both nodular and infiltrative, is at the bases; they rarely extend above the hilus. The nodular forms generally progress slowly, while the infiltrative forms have a much more rapid course and frequently cause pleural complications. Roentgen treatment with massive doses may bring about retrogression of the metastases, but much more slowly than is the case in sarcoma. In cancer of the breast the part of the lung beneath the primary tumor is generally invaded first. These metastases are generally nodular, either solitary or multiple. Carcinoma metastases in the lung are frequent and roentgen examination should always be made for them.—*Audrey G. Morgan.*

Palmer, J. P., and Taft, Robert B. Spontaneous pneumothorax. *J. Am. M. Ass.*, Feb. 28, 1931, *96*, 653–657.

The most frequent cause of this condition is tuberculosis, especially in adults. Idiopathic pneumothorax is very unusual and such a diagnosis is only justified after careful study of history, physical signs and roentgenograms fails to reveal an associated abnormality. The authors' cases include 5 regarded as idiopathic. This series is also unusual in that it includes 2 cases with massive hemorrhage.

But one fatality in 58 cases of idiopathic pneumothorax was reported. The prognosis of pneumothorax in tuberculous patients is grave. Pneumothorax frequently ushers in tuberculosis.—*E. W. Hall.*

Eichbaum, Franz. Geschwülstartige Aktinomykose der Lunge und des vorderen Mediastinums. (Tumor-like actinomycosis of the lung and anterior mediastinum.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, March, 1931, *43*, 346–357.

A case of actinomycosis occurring in a man aged forty-two is described in detail. The lesion started in the region of the right apex and extended by a tumor-like infiltration, without a tendency toward breaking down, into the anterior mediastinum, later producing metastases to the right kidney, to the diaphragm and to the brain. In connection with this case, the differential diagnosis of actinomycosis of the mediastinum and metastatic carcinoma is discussed.

A statistical study of the tissue specimens re-

moved at operation shows that actinomycosis occurred in 24 of a total of 7,114 cases, the distribution being as follows: 10 on the face and neck, 7 in the thoracic organs and 7 in the abdomen.—*T. Leucutia.*

Talia, F. Bronchospirochetosi cavitaria (Bronchospirochetosis in cavities.) *Radiol. med.*, Dec., 1930, *17*, 1370–1387.

In 1906 Castellani in Ceylon first described a form of bronchitis with bloody expectoration in which examination showed a form of spirochete which he called *Spirochaeta bronchialis*. This disease was at first thought to be a tropical disease but since then a good many cases have been described in Europe. The roentgen findings are slight or negative in most of these cases of bronchial spirochetosis except in the cases which have gone on to gangrene or cavities have formed. Among the 53 cases studied by Laiosse and Langle there were no roentgen findings worth mentioning. In the case studied roentgenologically by Besançon, Cajla and Scherrer there was a transverse opaque band which resembled the picture of interlobar pleurisy. There was improvement in the process under arsenobenzol treatment.

The author describes two cases in which there were cavities and illustrates them with roentgenograms. Roentgen examinations were made every three or four weeks throughout the course of the disease. He found that spirochetosis of cavities of the lung heals very slowly, unlike pyogenic abscesses, in which repair is much more rapid. The roentgen pictures of these cavities are very much like those of pyogenic abscesses that have been emptied; there is slight opacity at the center and intense opacity at the periphery due to the intense reaction of the tissues around the cavity, while the central lighter zone is due to destruction and elimination of the lung parenchyma. Repair takes place from the margin toward the center of the cavity; bands or ridges of shadow may persist caused by cicatricial tissue. Roentgen examination helps in the differential diagnosis of the disease but biological examination is also necessary.—*Audrey G. Morgan.*

Camentron. Calcifications pleurales chez d'anciens blessés de guerre. (Pleural calcifications in war veterans.) *J. de radiol. et d'électrol.*, April, 1931, *15*, 182–186.

Three cases of pleural calcifications occurring in war veterans as sequelae to old injuries of the chest are briefly described and illustrated with several roentgenograms.

Pleural calcifications in war veterans are not altogether rare. Generally, they appear in two forms: (1) as plaques of calcified pachypleuritis, and (2) as calcareous infiltration of the walls of old hematic cysts. It is interesting that both types of lesions are well tolerated, the patients having practically no symptoms.—*T. Leucutia.*

Cannavo, L., and Cola, G. La diagnosi radiologica delle fistole epato-bronchiali. (Roentgen diagnosis of hepatobronchial fistulas.) *Radiol. med.*, Feb., 1931, *18*, 244–255.

The authors describe two cases in which they diagnosed fistulae leading from amebic abscess of the liver into the bronchi by means of intrabronchial injections of iodized oil. The upper respiratory tract was anesthetized and the oil introduced by the transglottic route in the morning before breakfast, the injection being preceded by an injection of morphine or heroine. Ten or twenty minutes after the injection of morphine the pharynx, larynx and trachea were anesthetized with a tepid solution of 1 per cent cocaine hydrochloride containing 5 drops of a 1 : 1000 solution of adrenalin chloride. Then 30–50 c.c. 20 per cent iodipin was injected, having the patient lie on his right side so that the oil would sink into the lower part of the right bronchial tree. There were never any ill effects from the injections.

In both these cases the roentgen examination showed the site and number of the abscess cavities and their direct communication with the lumen of the bronchi, and the improvement under specific treatment could be followed up.—*Audrey G. Morgan.*

Bistolfi, S. Sulle complicanze pleuro-polmonari delle fratture costali. (Pleuro-pulmonary complications of fractures of the ribs.) *Radiol. med.*, Nov., 1930, *17*, 1255–1307.

An analysis is given of 1,528 roentgen examinations in 572 cases of fracture of the ribs in industrial accidents. Histories of 12 of the most characteristic cases are given and illustrated with roentgenograms. The author describes the different types of fracture and their relations to the pleuro-pulmonary complications found. The picture of traumatic pleurisy generally is not particularly different from that of ordinary serofibrinous pleurisy. Hemothorax shows increased density, particularly at the

base, and possibly obliteration of the costodiaphragmatic sinus. Pneumothorax shows the same picture as therapuetic pneumothorax except that there is more apt to be retraction of the hilus which is prevented by adhesions in therapeutic pneumothorax. Simple contusion of the lung, if mild, may not give any roentgen signs; if it is more serious, it may show a zone of opacity, denser toward the cortex and indistinct toward the center, corresponding to the anatomicopathological picture of hemorrhagic infarct with atelectasis of the lung. Traumatic pneumonia shows the same picture as ordinary pneumonia and the same is true of traumatic tuberculosis.

Pleuro-pulmonary complications are rarer in contusions of the thorax and fracture of the ribs than might be supposed considering the intimate relation between the wall of the thorax and the lungs; this is probably due to the elasticity of the lungs. Youth has a favorable effect in that the organs are more elastic and less vulnerable, but an unfavorable one in that the wall of the thorax also yields more readily and may injure a greater surface of lung and pleura and also because young people are more susceptible to certain diseases, particularly tuberculosis.

One reason why more roentgen findings of pleuro-pulmonary complications have not been reported is that examination is often incomplete and if these complications are not very severe they recover rapidly without causing real disease of lungs or pleura. Nevertheless serious disease may ensue. When it does it is generally caused by a predisposition on the part of the subject. A subpleural focus of injury for instance may cause dissemination of tubercle bacilli. The possibilities of serious disease are great enough to make careful roentgen examination of the thoracic organs important in such injuries.—*Audrey G. Morgan.*

Jaubert de Beaujeu, A. Sur l'examen radiographique de profil pour la localisation des affections intra-thoraciques. (On the profile roentgenographic examination for the localization of intrathoracic affections.) *J. de radiol, et d'électrol.*, March, 1931, *15*, 129–140.

The value of the lateral position in roentgen examination of the chest has long been known. The author himself recently demonstrated the importance of this in the localization and classification of mediastinal pleuritis.

The usual technique with the arms above the head so as to throw the scapulae backward and with a long focus film distance is recommended. For the visualization of the upper parts of the chest, especially the upper lobes of the lungs and the posterior mediastinum, the technique of Bársony and Koppenstein is advised. The following structures are well demonstrated on a lateral film: (1) sternum; (2) anterior mediastinum; (3) zone of superimposition of the right and left lungs; (4) posterior mediastinum (or clear retro-cardiovascular space or clear prevertebral zone); (5) spinal column.

The author, in conclusion, wishes to call attention to two essential points: (1) the frequent localization of lesions to the anterior part of the lungs, especially in the region of the right phrenocostal sinus, and (2) the marked resemblance in the lateral view of certain cases of mediastinal pleuritis to inferior interlobar pleuritis. In this latter, an examination in the posteroanterior position usually permits a differentiation. The article is illustrated with beautiful roentgenograms and diagrams.—*T. Leucutia.*

Allen, Kenneth D. A. The post-operative behavior of the diaphragm. *Radiology*, April, 1931, *16*, 492–507.

The author investigated the behavior of the diaphragm before and after a variety of abdominal operations, high and low. In 36 of the 94 cases studied, the right diaphragm on the day after operation was sharply arched and high, and in 5 cases the left diaphragm was similarly affected, but in neither group was there roentgenologic or clinical evidence of disease in the corresponding lung. In some instances the affected dome was still high three weeks later, but a few subsided markedly after three or four days. The immediate cause of the condition is undetermined, but may be due to paralysis. In 57 per cent of the 94 cases both diaphragmatic arches were elevated, from causes which were more obvious and which apparently do not include paralysis. Both phenomena, but especially the unilateral high diaphragm, deserve attention as the heart assumes a horizontal position suggesting displacement to one side or the other, and this, combined with a high position of one dome, may give an erroneous impression that atelectasis is present.—*J. D. Camp.*

Wahl, H. R., and Gard, Raymond L. Aneurism of the pulmonary artery. *Surg., Gynec. & Obst.*, June, 1931, *52*, 1129–1135.

Aneurysm of the pulmonary artery is an extremely rare condition. Only 70 cases have been described. Of these, 14 have been summarized and reported in this paper. There is also a detailed report of a case by the authors. It occurred in a young woman. It was opened by mistake, having been considered a solid mediastinal mass, and resulted in fatal hemorrhage.

These aneurysms are usually associated with some congenital anomaly of the heart and often have a syphilitic base. They have been reported most frequently in relatively early adult life. Their occurrence is sufficiently frequent to emphasize their consideration in the diagnosis of mediastinal masses.—*G. R. Miller.*

Biedermann, Fritz. Der rechtsseitige Aortenbogen im Röntgenbild. (The roentgen appearance of the right-sided aortic arch.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Feb., 1931, *43*, 168–187.

After a detailed discussion of the various anomalies of the great blood vessels and a résumé of the literature on the inverse position of the aortic arch, the author describes 7 cases of his own in which a right-sided aortic arch was observed. The cases are illustrated with numerous roentgenograms, diagrams and photographs of plaster models. They occurred in a total of 5,000 examinations of the thorax during a period of one and a quarter years.

The author advises that six roentgenograms be taken for the demonstration of the anomalies of the aortic arch, three without and three with filling of the esophagus with opaque substance, one each being taken in the sagittal, first oblique and second oblique positions.

There is great variation in the roentgen appearance of the right-sided aortic arch. In the roentgenograms taken after filling of the esophagus with barium a deviation or pressure of the esophagus is observed as a rule. If a blood vessel shadow appears between the esophagus and the spinal column, as has occurred in several of the author's cases, this is due either to the fact that the right-sided aorta reverses to the left side or if the descending aorta continues on the right side, to persistent left-sided aortic stump. The stump may be of different size and shape. Sometimes it appears as a large blood vessel running behind the esophagus nearly in a horizontal position from right to left, at other times it forms a diverticulum of a considerably enlarged descending aorta. Roentgenographically both may lead to visualization on the left side, this explaining the rather paradoxical phenomenon of a left-sided aortic knob in the case of a right-sided aortic arch.

The condition occasionally is associated with other anomalies or malformations of the heart and great vessels such as defect of the ventricular septum, stenosis of the pulmonary artery, etc. No difficulty of swallowing was observed in any of the author's cases.—*T. Leucutia.*

Jansson, Gösta. Beitrag zur Röntgendiagnostik beim Pericarddivertikel. (Roentgen diagnosis in diverticulum of the pericardium.) *Acta radiol.*, Feb. 14, 1931, *12*, 50–58.

A case of pericardial diverticulum is described in which the roentgen symptoms were very much like those in a case recently described by Kienböck and Weiss. It showed a roentgen symptom that has not been described before in mediastinal diagnosis, namely, that the shape of the pathological shadow was distinctly different during the various phases of respiration. During deep inspiration it was long and narrow, while under forced expiration it became rounder, shorter and broader. The whole shadow gave the impression of being soft, plastic and capable of changing form. This showed that it was due to an exudate and not to a solid tumor.—*Audrey G. Morgan.*

ABDOMEN

Bianchini, A. Sull'ernia diaframmatica. (Diaphragmatic hernia.) *Radiol. med.*, Oct., 1930, *17*, 1127–1149.

The author describes a case of diaphragmatic hernia in a man fifty years of age in which the roentgen picture showed all the stomach except the cardiac portion above the diaphragm, together with the splenic flexure and a long tract of the colon. The hernia was not reducible; the ring was large but there were strong adhesions. The patient was operated on and the hernia recurred. As he did not want to submit to another operation he was given irrigations of the stomach which improved his condition somewhat. This case differed from the classical cases of diaphragmatic hernia in that the whole of the stomach was visible in the frontal incidence, not the lateral one. The antropyloric region was not in front of the cardiac region but at the same depth and the different

segments of the stomach were superimposed on each other in the lateral view.

In connection with the case the author discusses the pathological anatomy of diaphragmatic hernia and relaxation of the diaphragm and their differential diagnosis. Gas is introduced into the stomach and an attempt made to localize the diaphragm with reference to the stomach. This is by no means easy. If the costodiaphragmatic sinus can be found it serves as a guide. For this purpose a screen examination should be made with the patient standing in different incidences, particularly the right anterior oblique and lateral, in which it is easier to follow the whole line of the diaphragm. If the diaphragm can be seen above the stomach it is obviously not a diaphragmatic hernia. The diagnosis of hernia is not certain unless the diaphragm is visible beneath the herniated organs. It is hard to determine this because the region of the hernia is traversed by a number of lines of shadow and it is hard to determine just which is the diaphragm. It is sometimes possible to discover the true line of the diaphragm by electrical stimulation of the phrenic at the neck but the results are complicated by the fact that the diaphragm is frequently adherent to the hernia. Indirect evidence may be furnished by demonstrating the hernial ring.

A long bibliography of the subject is given. —*Audrey G. Morgan.*

Schilling, C., and Sametnik, S. Vergleichende pathologisch-anatomische und röntgenologische Studien der Magen-Darmerkrankungen. (Comparative pathologico-anatomic and roentgenologic studies of diseases of the gastrointestinal tract.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, March, 1931, *43*, 306–321, and April, 1931, *43*, 395–406.

The authors made roentgenograms of anatomic specimens of the gastrointestinal tract in various lesions by using soft tissue exposure, and compared the roentgenograms so obtained with actual photographs of the specimens and in a few instances with roentgenograms of the gastrointestinal tract taken during life. The lesions investigated included malformations, inflammations (simple catarrh, dysentery, typhoid and paratyphoid fever, tuberculosis), polyposis, diverticulosis and neoplasms of the colon (first article) and of the small intestine (second article).

The procedure was found to have a certain didactic value. Both articles are richly illustrated with comparative photographs and roentgenograms —*T Leucutia.*

Smithies, Frank. Acute intestinal obstruction. *J. Am. M. Ass.*, Dec. 20, 1930, *95*, 1899–1903.

Intestinal obstruction is an emergency of the first rank. In this series of 56 carefully handled cases, 41 per cent died, the mortality being directly proportional to the delay in diagnosis. Acute obstruction should always be borne in mind in any "acute abdomen." Of small bowel obstruction cases, 82 per cent had initial severe pain, while only 8 per cent of acute colonic obstruction cases had this onset. Nausea and vomiting are almost equal to pain in diagnostic value. Roentgen studies are of great diagnostic importance but the use of barium is condemned. The author believes this measure one of the causes of perforation. Physical signs and management are briefly discussed.—*E. W. Hall.*

Nebout, J. Étude de la motricité gastrique. (Study of gastric motility.) *J. de radiol. et d'électrol.*, May, 1931, *15*, 225–237.

Following a brief description of the roentgenoscopic and roentgenographic (cinematographic, polygraphic) procedures, the author discusses in detail the tonicity and motility of the stomach. The tonicity is the expression of the state of the gastric walls, its various forms being orthotonic, hypotonic and hypertonic. Barrett described an additional form, the so-called hypertensive, in which the hypertonia is localized to the lower segment and to the corpus, while the upper pole presents a maximum distention. The motility is the result of muscular contractions and appears in the roentgenogram as a deformity of the gastric contour. A succession of contractions constitutes the gastric peristalsis, which is generally characterized by the site, amplitude, frequency, rhythm and the continuous progression of the contractions. Its forms are hyperkinesia, hypokinesia, akinesia and antiperistalsis. Since in the majority of instances there is a combination of two or more of these forms, the author suggests that they be called motor syndromes, the following varieties being distinguished: the roentgenologic syndrome of combat (type of pyloric stenosis); the roentgenologic syndrome of hyperexcitation (type of duodenal ulcer) and the roentgenologic syndrome of spasm. The

first is characterized by alternate crises of effort and periods of fatigue, the stomach endeavoring to overcome the barrier of stenosis. While the motility is good, the crises of effort will appear strong but later they will gradually weaken. Simultaneously the fatigue becomes more pronounced until finally the stomach will completely lose its ability to contract. Thus one may figuratively speak of a well-compensated stenosis, of a decompensated stenosis and finally of gastric asystolia. The second syndrome, that of hyperexcitation, is in a manner the reversal of the first. Thus while in stenosis the relaxation of the musculature constitutes the basic element, the crises of effort coming periodically in an endeavor to overcome the obstruction, in hyperexcitation a hyperkinesia is the chief characteristic, the periods of rest occurring at long intervals and being of shorter duration. In the third syndrome, that of spasm, there is a spastic contraction chiefly of the pylorus and less frequently of localized parts of the stomach or of the entire stomach.

If some portion of the gastric wall is infiltrated by a cicatricial tissue or by a neoplastic formation, a localized rigidity results, this being called segmental rigidity. If the infiltration extends to a greater portion or to the entire stomach a complete rigidity follows.—*T. Leucutia.*

LeWald, L. T. Roentgen diagnosis of gastric syphilis. *J. Am. M. Ass.*, Jan. 17, 1931, *96*, 179–183.

Gastric syphilis is much less rare than is usually supposed. It is especially likely to be overlooked in congenital syphilitics due to insufficient clinical data. An experienced roentgenologist should differentiate syphilis from gastric carcinoma, linitis plastica and ulcer. In borderline cases differentiation may be very difficult and may await clinical tests. Signs which should lead to a suspicion of syphilis are: diminished size with rapid emptying, large symmetrical defects in the pars media, giving rise to a dumbbell-like appearance, extensive infiltration with rather smooth outline. No recurrence of symptoms has occurred in a series of cases studied from ten to seventeen years. The author reports several cases and has observed over 50 cases.—*E. W. Hall.*

Pohlandt, Klaus. Die röntgenologische Diagnose und Differentialdiagnose der Tumoren des Bulbus duodeni. (The roentgenological diagnosis and differential diagnosis of tumors of the duodenal bulb.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, March, 1931, *43*, 337–346.

Briefly, the diagnostic criteria of tumors of the duodenal bulb are: (A) demonstration of a filling defect (*a*) with barium meal and (*b*) in relief examination; (B) elimination of other conditions which might lead to a filling defect: (*a*) of intraduodenal conditions (1) foreign bodies (gallstones, ingested foreign bodies, ascaris worms), (2) sequelae of ulcers; (*b*) of extraduodenal conditions (1) gall-bladder pressure, (2) pressure from enlarged retroperitoneal or subserous lymph nodes.

Three cases in which the roentgen examination led to the diagnosis of a benign tumor of the duodenal bulb are briefly described and illustrated with several roentgenograms. Only one of the cases was operated upon, a metastatic nodule from a melanosarcoma being found (the roentgen diagnosis was that of a myoma or fibroma). In the second case, the condition was roentgenologically diagnosed as benign tumor (myoma or fibroma) whereas in the third case a diagnosis of tuberculoma was made from the fact that the patient had evidence of concomitant tuberculosis of the cecum and ascending colon.—*T. Leucutia.*

Brdiczka, J. G. Abnorme Schleifenform der Pars superior duodeni und ihre differentialdiagnostische Bedeutung. (Abnormal loop form of the pars superior duodeni and its differential diagnostic significance.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Feb., 1931, *43*, 222–225.

Two cases of anomaly of the superior portion of the duodenum in which there was a U-shaped loop formation are briefly described and illustrated with roentgenograms. The differential diagnosis includes diverticulum of the duodenum and deformities of the bulb. The condition is the result of an abnormal ligamentum cholecystocolicum or of an idiopathic elongation of the superior part of the duodenum with U-shaped ptosis.—*T. Leucutia.*

Garvin, John D. Hyperplastic tuberculosis of the duodenum and terminal ileum. *J. Am. M. Ass.*, Nov. 8, 1930, *95*, 1418–1420.

Ulcerative intestinal tuberculosis is not uncommon in patients with pulmonary tuberculosis. The hypertrophic form is less common, and the author has found but 7 cases in which

the disease was confined to the ileum and but one case of ileal tuberculosis with uninvolved cecum and accompanying duodenal tuberculosis. This case is reported.

The striking feature of the disease is the thickening of the intestinal wall and narrowing of the lumen. Microscopically, as in this case, the peritoneal surface is studded with tubercles. Ulcers usually accompany the hypertrophy, but are a minor part of the picture. Papillomatous formations are often seen.

The author's case had had a previous roentgen diagnosis of duodenal ulcer due to bulbar deformity. Several examinations of the colon by enemas were negative The diagnosis of ileal tuberculosis was made by barium enema, there being noted a constant appearance of the terminal ileum and a rope-like sensation to palpation. The diagnosis of duodenal tuberculosis was made surgically at the occasion of gastroenterostomy to relieve obstruction at the gastric outlet.—*E. W. Hall.*

McClure, C. C. Hypertrophy of the pyloric muscle in adults. *Surg., Gynec. & Obst.*, May, 1931, *52*, 946–952.

Hypertrophy of the pyloric muscle in adults is a condition rarely reported in the literature but probably much more common in fact. It has been suggested that the condition has its etiology (1) in the congenital stenosis of infancy, (2) in the malfunction of the endocrine system and (3) in long-standing spasticity of the pylorus, due to such causes as nervousness.

The clinical picture of this condition is too frequently dismissed as neurosis because of the lack of organic deformity of the upper intestinal tract other than a constant oversized pyloric constriction on the roentgenogram. This fails to respond to atropine. Operation is the only cure. Five cases are reported.—*G. R. Miller.*

Balestra, Giovanni. Sul ceco eretto. (The erect cecum.) *Radiol. med.*, Feb., 1931, *18*, 161–202.

In 10 subjects studied roentgenologically, the author found an inversion of the cecum. The bottom of it was turned upward; it was either lateral, median or posterior with reference to the colon and either subhepatic, iliac or pelvic in position. There was no obstruction to canalization of the intestine. The chief subjective symptom was abdominal pain, the nature and intensity of which differed in different cases. Seven of the cases were operated on and it was found that the flexion of the cecum was maintained by pericecal or peri-appendicular adhesions or pericolic membranes; it was possible in all the the cases to restore the cecum to its normal position. In 4 of the cases operation was performed some time ago and there have been no symptoms since.

Abnormal mobility of the cecum is a prerequisite for these anomalies of position; different factors act on such a mobile cecum to bring about displacement. It is hardly possible to determine whether the displacement is congenital or acquired; in some cases there seem to be some factors that are congenital and others that are acquired. Erect cecum should be distinctly differentiated from malplacements of the cecum due to abnormal rotation of the intestine or insufficient descent of the primordial loop. This differentiation is based on the lack of changes in length and dystopies in other segments of the colon, particularly the ascending colon, though this part of the intestine may show abnormal mobility. This differentiation is important in deciding on surgical operation.

The only certain way of diagnosing such displacements is by roentgen examination.—*Audrey G. Morgan.*

Sandera, Robert. Diagnose und Differentialdiagnose des Mesenterium ileo-colicum commune in Röntgenbilde. (Roentgen diagnosis and differential diagnosis of mesenterium ileo-colicum commune.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Feb., 1931, *43*, 207–221.

Mesenterium commune represents a continuation of an embryonic state consisting in disturbed rotation of the umbilical loop of the primitive bowel. As is known, during the fifth week of fetal life the bowel may be divided into three parts: the fore gut, the mid gut (or umbilical gut) and the hind gut. The mid gut entering through the umbilical orifice rotates around its axis, three stages being distinguished: the first stage from the fifth to tenth week, the second from the tenth to eleventh week and the third after the twelfth week. The mechanism of the rotation in the three stages is discussed at length by the author.

The variations from the normal may consist in Stage I of non-rotation but since this is always associated with extroversio cloacae it is never observed in the living; in Stage II of non-rotation or reverse rotation or mal-rotation,

and in Stage III of disturbances of more-local character such as lack of longitudinal growth of the colon, non-descending cecum, etc.

Three cases representing disturbances chiefly of Stage II are described in detail. In addition to these, 13 cases were collected from the literature and also analyzed. It was found that the following roentgen signs were of importance: (1) a change in the normal position of the duodenum with absence of the duodenojejunal flexure; (2) a right-sided position of the small intestine; (3) a malposition of the cecum, either in the small pelvis or in the left iliac fossa or in front of the lower lumbar spine, etc.; (4) an ascendance of the proximal colon directly to the angulus colicus; (5) a normal position of the descending and pelvic colon, in about one-third of the cases the descending colon being of the dolichocolon type, and (6) a U-shaped form of the distal portion of the transverse colon occurring in one-third of the cases.

Schematically the roentgen signs of mesenterium commune resulting from disturbed rotation in the second stage may be arranged as follows: (1) non-rotation: (*a*) with shortening of the proximal colon, (*b*) with normal length of the proximal colon, the signs being in both instances those mentioned above; (2) inversed rotation, the duodenum crossing the transverse colon ventrally; (3) mal-rotation (A) (*a*) a U-loop (with variation); (*b*) position of the small intestine in the left abdomen; (*c*) absence of the proximal colon, the cecum being in the subpyloric region; (*d*) normal appearance of the colon from the splenic flexure downward; (B) (*a*) position of the duodenum and small intestine the same as in non-rotation; (*b*) non-shortening of the transverse colon, and (*c*) presence of cecoascendens liberum.—*T. Leucutia.*

Yeomans, Frank C. Sigmoidoscopy versus x-rays in the diagnosis of terminal bowel disease. *J. Am. M. Ass.*, Dec. 20, 1930, *95*, 1907–1910.

Too much dependence is usually placed on the roentgen ray in diagnosis of lesions of the sigmoid and rectum, since by the roentgen method a lesion may be easily overlooked or misinterpreted. Every case presenting intestinal symptoms should have first a digital examination then a proctoscopic or sigmoidoscopic examination prior to roentgenography. The sigmoidoscope can be passed into the colon in more than 70 per cent of the cases. Microscopic examination of excreta and of biopsy material is important.—*E. W. Hall.*

Feldman, Maurice. Cholecystography: An analysis of 500 cases observed by means of the oral method. *Radiology*, Dec., 1930, *15*, 675–680.

It is the author's purpose in this paper to analyze the data obtained in a series of 500 cases of suspected gall-bladder disease and evaluate the reliability of the test.

Tetraiodophenolphthalein administered in five-grain enteric-coated capsules was utilized in this series. The doses varied in different individuals, depending upon the weight and stature of the patient. The dose was given uniformly by body weight. From twelve to twenty-six capsules may be given. In order to obtain uniform results the maximum dose of the dye is recommended. The dye is harmless when given orally, and, since there is at times a question of how much of the dye is really absorbed in the intestinal tract, the larger dose fully allows for adequate absorption. In one instance thirty-six capsules were given to a patient without any ill effect.

Of the 500 cases, cholecystographic studies yielded the following: 287 cases revealed abnormal findings and were diagnosed as pathological, while 213 were diagnosed as normal. The gall-bladder filled in 358 cases, 116 of which filled poorly and 242 filled well. In 142 cases the gall-bladder failed to fill. In 57 instances gallstones were found, 30 of which were of the negative type and 27 of the positive type. In 302 cases of filled gall-bladders, 208 contracted normally, 46 abnormally, and in 47 the vesicle shadow was absent following a fatty meal.

Eighty-six (17.2 per cent) of the cases came to operation; in 81 (94.2 per cent) the diagnosis was proved correct. Of the 81 proved operative cases, 68 were pathological and 13 were normal. In 5 instances an error of diagnosis was made; in 3 of the 5 instances the diagnosis of pathology was made on poor filling of the gall-bladder, and in the other 2 the error was due to faulty interpretation. Of the 86 operative cases, 37 showed an absence of the gall-bladder shadow in the sixteen-hour examination. At operation, 30 of these revealed stones, and in 7 cholecystitis was found. Of the 49 filled gall-bladders which came to operation, 24 revealed stones, 7 cholecystitis, and 18 were found to be normal. It is also of interest to note that of the

49 cases of filled gall-bladders, the roentgen diagnosis of pathology was made in 20 instances on poor filling, in 7 on negative stone shadows, and in 6 on positive stone shadows. Normal findings were noted in 16 cases.

It is obvious from these findings that the highest percentages of correct diagnoses were confirmed in the cases which showed evidence of stones and in those which showed an absence of the gall-bladder shadow. The few errors which do occur are usually in the poorly filled and in the normal cholecystographic tests.

Jaundice occurred in 12 cases and in every instance the gall-bladder failed to fill. Robins and Goldberg cite 9 instances of catarrhal jaundice which revealed no shadow, and on re-examination, after the termination of the jaundice, some of the cases showed normal filling of the gall-bladder.

Vomiting occurred in 84 (16.8 per cent) of Feldman's cases. In no instance could vomiting account for the non-filling or poor filling of the gall-bladder, regardless of the time when the vomiting occurred, provided the full dosage had been taken. Occasionally a denser shadow was noted in cases that vomited. Diarrhea occurred in but 30 instances in this series.—*J. D. Camp.*

Sandström, Carl. Eine verbesserte administrationsweise bei den peroralen Cholecystographien mittels wiederholter Verabreichung des Contrastsalzes. (An improved method of peroral cholecystography by giving the contrast medium in repeated doses.) *Acta radiol.*, Feb. 14, 1931, *12*, 8–22.

The author describes a new method of giving the contrast medium for purposes of peroral cholecystography. Instead of giving it in one dose or in the course of a single evening, as has been the custom before, it is given in repeated doses some days—preferably two— before the roentgen examination is made. The advantage of this method is that the tetraiodophenolphthalein, because of its slow elimination, continues to circulate in the body for a considerable time after it is given, and so has a cumulative effect in the contrast filling of the gall-bladder. The results obtained are markedly better than those obtained by the old method and the author thinks they are fully equal to those obtained by the intravenous method. In a relatively large number of cases in which there was no filling at all by the old method or only a faint shadow which was hard to interpret, the new method gave a much more complete contrast filling. Roentgenograms are given showing the difference in the pictures of the same case by the old and new methods.—*Audrey G. Morgan.*

Rudisill, Hillyer. Gall-bladder visualization in jaundiced patients. *J. Am. M. Ass.*, Nov. 8, 1930, *95*, 1425.

It has been generally assumed that it is inadvisable to use cholecystography in jaundiced patients because non-visualization usually results or because the reaction may be too severe. In 7 patients with jaundice, clinically diagnosed as catarrhal jaundice, there was normal visualization of the gall-bladder with no evidence of stone. In one similar case the gall-bladder was not demonstrated. In one deeply jaundiced patient a well-visualized gall-bladder with stones was found. In the tenth case of jaundice the gall-bladder was not visualized and carcinoma of the common duct was found at operation. None of the patients suffered an unusual reaction to the dye. The author concludes that jaundice is not a contraindication to the use of intravenous cholecystography, and this method usually gives valuable information as to diagnosis.—*E. W. Hall.*

Bockus, H. L., Shay, Harry, Willard, J. H., and Pessel, J. F. Comparison of biliary drainage and cholecystography in gallstone diagnosis. *J. Am. M. Ass.*, Jan. 31, 1931, *96*, 311–317.

Nonsurgical biliary drainage is an examination of paramount importance in the positive diagnosis of gallstones. Finding both cholesterol crystals and bilirubin calcium pigment in bile is pathognomonic of cholelithiasis. To obtain the pigment it is necessary to evacuate some bile from the gall-bladder by stimulating solutions. The microscopic identification requires some skill and careful search. This method is more accurate than cholecystography, the percentage of correct diagnoses in this series of 148 proved cases being 98 by the biliary drainage method as against 88.4 per cent by cholecystography. In the series of proved cholelithiasis, biliary drainage was 83.2 per cent correct in indicating the presence of stones as against 29.2 per cent by cholecystography. Due to the necessity of obtaining B bile from the gall-bladder for the microscopic method, intravenous cholecystography is superior to this method as well as to oral cholecystography if only one study is carried out.—*E. W. Hall.*

Jacquet, Paul, and Gally, Leon. Le diagnostic radiologique de l'appendicite chronique. (The roentgen diagnosis of chronic appendicitis.) *Bull. et mém. Soc. méd. de hôp. de Par.*, Feb. 2, 1931, *55*, 129–139.

The presence of a tender point as shown by fluoroscopic examination along the inner border of the cecum is a roentgen sign of first importance in the diagnosis of chronic appendicitis. But Jacquet and Gally believe the diagnosis cannot be made unless there exists an associated roentgen syndrome which is caused by the participation of the cecum, ascending colon and the ileocecal valve in the pathologic process known as chronic appendicitis. To demonstrate this syndrome the patient must be given a barium meal and examined six hours after its ingestion. In a normal subject at the time of the examination, the barium is scattered through the cecum and ascending colon as far as the hepatic flexure and only a very small residue remains in the ileum.

The syndrome consists of delay in the passage of the barium through the ileocecal valve, in the demonstration of spasm of the terminal ileum and the cecum, with or without visibility of the appendix.

By ileal stasis the authors do not mean stasis produced by a complete or almost complete arrest of the barium at the ileocecal valve, or by occlusion of the ileum near the valve, such as might be caused by carcinomata in these areas, ileocecal tuberculosis or adhesions. In chronic appendicitis there is almost always a slight delay, the ileum is hypertonic, and the roentgen appearance is far different from that seen in cases of delay due to visceral ptosis and atony of the intestine. In the latter there is often a distention of the last 20 cm. of the ileum with large scattered accumulations of barium.

In regard to spasm, there is the first type, spasm of the ascending colon which is not constant and second, localized ileocecal spasm. In the fluoroscopic examination when the first can be demonstrated there is visible a frank pathological irritability of the colon, it having a hacked or saw-tooth appearance conveying the impression of a pericolitis.

In the case of ileocecal spasm there are definite and constant characteristics which make it easily recognizable. When compression is employed over the tender point by the gloved hand or a manipulator, a general or localized retraction of the bowel with a vermiform movement is produced. The cecum often has a rectilinear outline of its inner border and deep incisurae on its outer border. It may be sometimes retracted en masse and even assume a conical shape, so small on occasions that it resembles a diverticulum, thin as a pencil, and may even be mistaken for the appendix itself. Anesthesia releases such spasm. Often under the point of maximum tenderness a deep incisura may be seen along the outer border of the cecum. Spasms of the ileum are rapid, transitory and sharply localized.

In regard to visibility of the appendix, the authors believe that superposition of a tender point over the image of the appendix is a confirmatory sign but visibility is not actually necessary for making a diagnosis. Often they do not obtain visibility.

They have had operative confirmation of their positive diagnoses.—*R. S. Bromer.*

Laroche, Guy, Brodin, and Ronneaux. A propos du diagnostic radiologique de l'appendicite chronique. (Roentgen diagnosis of chronic appendicitis.) *Bull. et mém. Soc. méd. de hôp. de Par.*, Feb. 23, 1931, *55*, 244–246.

The authors cannot wholly agree with Jacquet and Gally (see above abstract) who have stated that a roentgenologic diagnosis of chronic appendicitis can only be made if a tender point is elicited along the inner border of the cecum, associated with stasis in the terminal ileum after six hours and with definite ileal stasis. They believe that many patients who show definite clinical signs of appendicitis, have definite tenderness on palpation in the right iliac fossa, but on the other hand, there is a rarer group which shows no tenderness or only shows it intermittently.

In the first group of cases the existence of a tender point directly over the appendix when it is visible, or in some cases when visibility of the appendix is lacking, a tender point over the inner border of the cecum above the ileocecal junction, which moves with the cecum or change of position of the patient, constitutes, according to the authors, the most dependable point in the roentgenologic diagnosis of chronic appendicitis. In a great number of cases they found neither ileocecal spasm nor ileal stasis, and therapeutic results have shown that these patients really had chronic appendicitis.

In the second group of cases, the authors think the signs of Jacquet and Gally have some diagnostic value. But several causes of error

must be first eliminated for these signs to have any real value. Six hours after ingestion of barium seems to them to be too short a time in which to determine ileal stasis. A complete study of the digestive tract must be made to eliminate delay in the evacuation of the stomach, pyloric spasm or slight pyloric stenosis, all of which might cause a secondary delay in the passage of the barium through the ileum. Also marked ptosis or intestinal adhesions might cause such delay. Spasm of the cecum appears to have some value as a diagnostic sign if it is strictly localized to the cecum and is not accompanied by signs of spasmodic colitis in other portions of the colon.

With due regard for these possible sources of error, the authors believe the indirect signs of Jacquet and Gally can be of service in the diagnosis of this difficult condition. They feel that ileal stasis cannot be considered as a factor in the diagnosis unless it is decidedly marked and can be proved to be due to causes originating in or around the terminal ileum itself.—*R. S. Bromer.*

Leonard, Marion. Tuberculosis in the mesenteric lymph nodes of children. *Am. J. Dis. Child.*, March, 1931, *41* 513-527.

The author reviewed the autopsy records on children under fifteen years of age dying in the New Haven Hospital over a period of thirteen years (1917–1930). All incomplete records were discarded and there remained 161 autopsies which contained positive statements of negative observations regarding tuberculous foci, and in which statements of positive observation were, practically without exception, substantiated by microscopic preparations of each tissue listed. The aim of the investigation was an analysis of the clinical and pathological records in an attempt to study the incidence of tuberculosis in the mesenteric lymph nodes with other localizations of the disease.

The author's conclusions follow:

1. The high incidence of tuberculosis in the mesenteric lymph nodes of children is brought out in this study.

2. Contrary to prevailing opinion, there seems to be little relation between chronological age and calcification as a pathologic process in children.

3. The significant value of 0.94 for the coefficient of association of tuberculous involvement of the mesenteric nodes and other tissues suggests that the intestinal lymphatic system plays an important rôle in tuberculous infection in childhood.

4. The fact that the mesenteric nodes are the only tissues in the body that are the sole demonstrable site of tuberculous infection in any single case (18 instances, or over one-third of the cases studied) also points to the importance of the intestinal lymphatics in the infection of children with tubercle bacilli.—*R. S. Bromer.*

Benhamou, Viallet and Marchioni. Anatomie et physiologie radiologique de la rate. (Roentgenologic anatomy and physiology of the spleen.) *J. de radiol. et d'électrol.*, March, 1931, *15*, 147–154.

In a previous communication, the authors have reported the respective advantages of roentgenoscopy and roentgenography for the exploration of the spleen and have indicated the best technique to be followed. In the present article, the anatomy, the morphology and the relation of the spleen to the neighboring organs as evidenced in the roentgenograms is discussed in detail. In a separate chapter a new method for the cinematographic study of the spleen is described. This consists in the taking of serial roentgenograms after a subcutaneous injection of adrenalin. Pagniez, Coste, Escalier and Solomon previously observed in a case of malarial splenomegaly that the spleen contracted under the influence of adrenalin for a period of about fifteen minutes. In the authors' experiments, it was established that the contraction begins regularly five minutes after the injection, increases up to twenty minutes, remains stationary until thirty minutes and then gradually decreases, returning to normal within sixty minutes or occasionally somewhat longer. A study of the hematologic picture during the same time revealed that the first contraction is due to expulsion of the blood platelets, which are the lightest and most mobile elements, from the sinus of the spleen whereas the maximum contraction is the result of expulsion of the red blood cells which are heavier and less mobile. The number of blood platelets in the circulating blood increases, beginning five minutes after the injection, from 350,000 to about 600,000 and the number of red blood cells increases in ten to twenty minutes from 5,000,000 to about 6,000,000. A second injection three quarters of an hour or an hour later produces a repetition of the same phenomenon, that is, expulsion of the platelets first and of the red blood cells later.

During the course of further studies, the authors found that the above behavior of the spleen under the influence of adrenalin can be used advantageously for a differential diagnosis in certain splenomegalies. Thus spleens, in which the enlargement is due to congestion (as in infections, malaria, etc.) contract and decontract following injection of adrenalin at the same rate as in the normal, while large spleens belonging to the group of Banti's disease or of other pathologic processes (tumors, leucemic state, etc.) remain entirely uninfluenced. Furthermore, the demonstration of a contractility indicates that the spleen still possesses a certain physiologic function thus contraindicating surgical removal, while splenectomy is reserved for cases entirely devoid of function.

In discussing generally the differential diagnosis of tumors of the left hypochondrium, the authors found that the following procedure is the most advantageous: (1) a simple flat film for the visualization of the spleen; (2) the adrenalin test for the study of the contractility of the spleen, and (3) the administration of a barium meal (or in rarer instances gastrocolic insufflation or pneumoperitoneum or, finally, pyelography) for the elimination of lesions of the neighboring organs.—*T. Leucutia.*

Kadrnka, Silvije. L'hépatosplénographie. (Hepato-splenography.) *J. de radiol. et d'électrol.*, June, 1931, *15*, 291–296. Also *Fortschr. a. d. Geb. d. Röntgenstrahlen*, July, 1931, *44*, 9–15; *Bull. et mém. Soc. de radiol. méd. de France*, March, 1931, *19*, 104–107.

The visualization of the liver by means of an opaque substance was first tried in animals by Einhorn who used tetraiodophenolphthalein. Later Oka of Japan and Radt in Germany attempted the opacification of the spleen, and occasionally of the liver, by employing a colloidal substance of thorium base, the so-called tordiol, which was injected intravenously. Although some good roentgenograms were obtained in animals, the method was tried in humans only recently. It was found, however, that the injections were followed by phenomena of intolerance, this limiting greatly the clinical application. Moreover, since every non-stabilized colloidal substance such as tordiol, umbrathor, etc., leads to precipitation of biocolloids and electrolytes, the injection of such substances into the human organism must be considered as distinctly dangerous.

The author recommends the use of a new substance, the so-called thorotrast, which is a stabilized colloidal suspension and does not lead to precipitation when in contact with humoral liquids. The substance contains 25 per cent by weight of thorium dioxide and 22 per cent by weight of thorium metal. Following intravenous injection into the organism, it is retained principally by the cells of the reticulo-endothelial system of the liver and spleen, rendering them, owing to the very high atomic weight of thorium, opaque to the roentgen rays.

Technique of Injection. The preparation is administered in doses of 0.80 to 1 gm. thorotrast per kilogram body weight, divided into four to six fractions of gradually increasing amount (0.10, 0.20, 0.30, 0.40 gm. per kilogram body weight) which are injected within a period of four to six days, the last injections being made as a rule every second day. In case of hypersensibility the dose is administered in smaller fractions (0.10, 0.15, 0.20, 0.25, 0.30 gm.) and at somewhat longer intervals. The thorotrast is diluted to at least nine times its volume with 5 per cent glucose solution, sterilized by boiling and injected slowly in a manner similar to uroselectan or tetraiodophenolphthalein.

Roentgen Technique. Twenty-four hours following the last injection, the first roentgenogram is taken after a preliminary enema. One film is taken to show both the liver and spleen and then films are made for each of these organs separately with a special technique. For the liver the incidence is dorsoventral, the tube forming an acute angulation of 60 to 70° caudally (the patient being in ventral decubitus), while for the spleen the incidence is likewise ventrodorsal and inclined from below upward but tilted obliquely from right to left.

Results. The opacity of the liver obtained in the normal cases is slightly more accentuated than that of the vertebral column, while that of the spleen is a little darker than the ribs.

Indications. It is too soon yet to form definite indications but it is probable that the method will be of value especially in two groups: (1) in tumefactions (neoplasms, cysts, abscesses, etc.) which lead to circumscribed lacunar images, and (2) in diffuse parenchymatous affections (cirrhosis, etc.). In certain instances the method will aid in the differential diagnosis by simply demonstrating the contours of the liver and spleen (in such cases the injection of a third or half of the above dose will prove sufficient).

Contraindications. The method will probably

be contraindicated in case of severe diffuse alterations of the parenchyma of the liver and spleen and in case of marked renal insufficiency.

Accidents. The injection of thorotrast is followed by a transitory reaction, identical to that observed following the injection of protein bodies or other colloidal substances. A certain number of individuals present a hypersensibility, this leading to phenomena of intolerance. As already mentioned, in such instances the substance must be administered in smaller fractions and at longer intervals. An experience of now over five months has shown that the thorium administered in such small doses (10 to 12 gm. of thorium metal in a man of 60 kg.) does not represent any danger to the organism. The effect from its radioactivity is likewise practically negligible.

The conclusion is reached that the administration of thorotrast under rigorously observed precautions leads to satisfactory results both from the roentgenologic and clinical standpoints. Its indications, however, must as yet remain limited until a sufficiently large number of cases have been examined.—*T. Leucutia.*

GENITOURINARY SYSTEM

Braasch, William F., and Bumpus, Hermon C. Jr. Report on sodium 2-oxo-5-iodopyridine-N-acetate (introduced as uroselectan) to the Council on Pharmacy and Chemistry of the American Medical Association. *J. Am. M. Ass.*, Nov. 8, 1930, *95*, 1425–1427.

A brief historical review of the use of intravenous injections to visualize the kidney pelvis is given. The technique of administration, as worked out by Swick, is described: 40 gm. of the powder being dissolved in 100 c.c. of sterile distilled water, twice filtered and again sterilized, then injected into the arm at body temperature. Symptoms of warmth, pain in the arm and shoulder, dryness of the mouth and throat and occasionally nausea and vomiting may occur within the first ten minutes—never later. Roentgenograms are made at fifteen minutes after injection and repeated in thirty minutes, and at suitable intervals for several hours, depending on rapidity of secretion.

Kidney function is apparently not definitely determined by the degree of visualization, there being at times poor visualization with normal function, and vice versa. Though unsatisfactory as yet as a renal function test, it provides a valuable adjunct to renal diagnosis. No alarming sequelae to the use of uroselectan are to be expected.—*E. W. Hall.*

Bøggild, David. Some experiences with intravenous pyelography by means of uroselectan. *Acta radiol.*, Feb. 14, 1931, *12*, 41–49.

The author reports 12 cases of intravenous pyelography with uroselectan and describes 3 of them in greater detail, contrasting the findings with intravenous and direct pyelography. The cases illustrate the advantages and disadvantages of intravenous pyelography with uroselectan. One practical disadvantage is that this contrast fluid is sometimes excreted rapidly, sometimes slowly, which makes it necessary to take a good many exposures in order to get a satisfactory result. And unless the urinary passages are abnormally dilated the contrast shadows are rather faint, which makes fluoroscopic observation impossible. Another result of the faint shadow is that small calculi may be overlooked. As the contrast fluid is excreted with the urine, intravenous pyelography gives a more physiological picture of the urinary passages than the one obtained by the direct method, but for the same reason it is hard to get a picture showing the lower part of the ureter.

The great advantages of pyelography with uroselectan lie in the general survey that it gives of the kidneys, ureters and bladder and in the fact that it gives its best results in cases in which obstruction in the ureters makes pyelography by the direct method impossible. Pyelography with uroselectan can be used without hesitation in cases in which catheterization of the ureters is inadvisable from fear of introducing infection into a healthy ureter or where there is tuberculosis of the kidneys.—*Audrey G. Morgan.*

Von Lichtenberg, A. Intravenous pyelography. *Radiology*, Dec., 1930, *15*, 664–669.

The author states that intravenous pyelography with uroselectan is indicated (1) in those cases in which cystoscopy, catheterization of the ureter and instrumental pyelography cannot be performed because of anatomic, pathologic or technical reasons; (2) in all cases of ureteral obstruction in which the contrast substance introduced by means of instrumental pyelography does not pass the point of obstruction, and (3) in those cases in which instrumental pyelography cannot be undertaken without risk to the patient. This last group

should include those patients whom one wishes to spare the pain of catheterization and of whose condition one can obtain sufficient information through intravenous pyelography. Specifically, the intravenous method is applicable in patients suffering from stricture, severe bladder affections, hemorrhage, fistula, and in small children. It is applicable also in cases in which one hesitates to use the catheter, namely, in cases of acute and chronic inflammatory infections of the adnexa, in tuberculosis and in cases of prostatic hypertrophy.

A diagnostic film can be expected only in cases in which renal function is present, and the density of the shadow is dependent on the amount of function that exists. The shadow will be absent, faint or considerably delayed in severe bilateral infections of the kidneys, particularly those conditions associated with a damaged purulent parenchyma.—*J. D. Camp.*

Lau, Frederick T., and Henline, Roy B. Ureteral anomalies. *J. Am. M. Ass.*, Feb. 21, 1931, *96*, 587–591.

A case is reported in which three ureters were found on one side, with one ending blindly in an aplastic kidney, and a bifid pelvis with a single ureter on the other side. Several instances of three or more ureters on a side have been mentioned in the literature but the descriptions are inadequate and inconclusive. Roentgenograms with catheters in place as well as after retrograde and intravenous pyelography are reproduced.—*E. W. Hall.*

Herbst, Robert, and Vynalek, William J. Solitary serous renal cysts; with a study of roentgen observations. *J. Am. M. Ass.*, Feb. 21, 1931, *96*, 597–602.

Solitary cysts are rather uncommon clinically, but are increasingly found with improved diagnosis, reported cases now numbering over 160 as against 48 cases in 1920. Pathologists find them in 3 to 15 per cent of autopsies. Clinical symptoms are usually absent except in large cysts.

Roentgen findings vary and may include: (*a*) a normal pyelogram; (*b*) pyelectasis; (*c*) compressed calyces; (*d*) change in position and axis of the kidney; (*e*) the shadow of the cyst itself; (*f*) calcium deposits in the cyst wall.

Resection of a wedge including the cyst is indicated, as a rule, rather than nephrectomy. Six cases are reported.—*E. W. Hall.*

Caylor, Harold D. The pathology of malignant bladder neoplasms. *J. Am. M. Ass.*, Dec. 6, 1930, *95*, 1736–1741.

Papillomas of the urinary bladder should be considered as low grade papillary epitheliomas. Bladder neoplasms may be classified into grades in the same manner as skin epitheliomas. Grade 1 shows the highest degree of differentiation of cells and is least malignant, since differentiation checks growth and invasion. Grade 4 is least differentiated, the cells being large and irregular with many mitotic figures and far exceeding the stroma present. Grades 1 and 2 are intermediate degrees of cell differentiation.

Removal of specimens for diagnosis is urged as being of diagnostic and prognostic value and not increasing the rate of growth of the tumor or causing metastases. Specimens from all parts of the same bladder tumor are of nearly the same degree of malignancy. If multiple epitheliomas are present each should be examined microscopically.—*E. W. Hall.*

Arendt, Julius. Das Chorionepitheliom des Mannes. (Chorionepithelioma of the male.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, June, 1931, *43*, 728–735.

Schultze, a few months ago, described the second case of extragenital chorionepithelioma occurring in the male. The author now contributes the third case which was localized to the mediastinum of a young man twenty years of age, without involvement of the testicles. The lesion later produced extensive metastases to the lungs and liver, which failed to respond to radiation therapy.

It is interesting that the growth of the tumor was associated with a very pronounced hormone effect, which led to systemic over-development and to the appearance of female sexual characteristics such as hypertrophy of the breasts, lactation and regression of the genital organs. Likewise there was a marked increase in the secretion of the anterior lobe of the pituitary gland with a strongly positive Aschheim-Zondek reaction. It must be mentioned, however, that there was no psychic inclination to pseudohermaphroditism or homosexuality. The case is exceedingly rare.—*T. Leucutia.*

SKELETAL SYSTEM

Campbell, D. Über die Dysostosis craniofacialis (Crouzon) und die Akrozephalie (Apert). (On dysostosis cranio-facialis (Crouzon) and acrocephaly (Apert).) *Fortschr. a.*

d. Geb. d. Röntgenstrahlen, March, 1931, *43*, 358–362.

I. Crouzon in 1912 for the first time reported a condition which he called "hereditary cranio-facial dysostosis" and which was characterized by three cardinal symptoms: (1) deformity of the skull; (2) deformity of the face, and (3) ocular disturbances. In 1924 after a detailed review of the cases published up to that time, he described the various changes as follows: (1) the deformity of the skull consisted of a dome-shaped prominence of the frontal bone near the greater fontanelle with an elongated prominence along the frontal and occasionally sagittal sutures leading as a whole to a trigonocephalic or scaphocephalic appearance; (2) the deformity of the face was the result of a hypoplasia of the upper maxillae and consisted of a widening of the bridge of the nose with flattening of the dorsum leading in profile to a parrot-beak appearance, and of a shortening of the upper lip and posterior position of the upper incisors; (3) the ocular disturbances were secondary to malformation (reduced depth) of the orbital cavities and consisted of protrusion of the eyeballs, increased distance between the pupils (hypertelorismus), divergent strabismus and later choked discs and total atrophy of the optic nerve. In 1929 after further study of the problem, Crouzon found that the condition is not always familial but that it may occur also individually. He distinguished three stages of evolution: (1) the stage of developmental disturbance and premature synostosis of the sutures; (2) the stage of compensatory expansion of other bones of the skull, and (3) the stage of increased brain pressure phenomena.

The author recently observed a typical case of Crouzon's disease which occurred in a boy 6½ years of age. It is interesting that the boy in the first year of life suffered from hydrocephalus, there being a wide separation of the frontal suture. Despite this, a premature synostosis with all the typical symptoms of Crouzon's disease developed. The case is described briefly and illustrated with photographs and a roentgenogram of the skull.

II. Another type of cranial deformity occurring in association with syndactylia was reported by Apert and termed acrocephalosyndactylia. In this deformity the skull assumes an ovoid appearance due to a very marked prominence of the frontal bone and a parallelism of the vertex with the base of the skull. Here also there is a premature occlusion of the suture lines leading in the later stages of the disease to signs of increased intracranial pressure. However, the deformity of the face and the eye disturbances are, contrary to Crouzon's disease, entirely absent.

The author observed a case of acrocephaly (Apert) without syndactylia. This case is also briefly described and illustrated with a roentgenogram.

The opinion is expressed that developmental deformities of the skull may occur singly or in association with other anomalies such as deformities of the face (dysostosis cranio-facialis Crouzon) or syndactylia (acrocephalosyndactylia Apert). Conversely, Bauer observed one case of Crouzon's disease in which the facial deformities occurred without the presence of deformities of the skull, the same being true of syndactylia.—*T. Leucutia.*

Cohn, Max. Ein Fall von Dysostosis cleido-cranialis. (A case of dysostosis cleido-cranialis). *Fortschr. a. d. Geb. d. Röntgenstrahlen*, March, 1931, *43*, 363–366.

A rather unusual anomaly of the skull was accidentally observed in a case of primary carcinoma of the bronchus referred for roentgen examination for possible metastases to the skull. The anomaly consisted in the presence of a gap extending from the greater fontanelle across the lesser fontanelle to the frontal bone. Associated with this there was a rudimentary development of the left clavicle consisting in a double clavicle united by a pseudo-arthrosis. Following the death of the patient, the skull and the left shoulder girdle were macerated and a very good view of the anomalous condition obtained. The roentgenograms taken in vivo, as well as the photographs of the macerated specimens, are included. The condition was placed in the group of "hereditary cleido-cranial dysostosis" described by Mark and Sainton.—*T. Leucutia.*

Kadrnka, Silvije, and Naz, Edouard. Bursolithiase sous-tricipital. (Subtricipital lithiasis of the bursa.) *Acta radiol.*, 1931, *12*, 236–239.

A case is described in a young girl of eighteen who, in addition to doing ordinary household work, rang the bells of the village church. When she entered the hospital she had a large calcareous bursitis between the tendon of the triceps and the lower part of the humerus just above the tip of the olecranon. This bursitis had de-

veloped gradually and had not become manifest until six months before when she suffered a direct trauma. She recovered quickly from the inflammation of the trauma but the bursitis continued to progress. It caused functional disturbance of the joint and some irritation of the radial nerve. There was no history or evidence of tuberculosis or any other chronic infectious disease. She had a certain amount of neurovegetative disequilibrium which seemed to have originated from a scarlatina in childhood.

The bursa was extirpated. It was in the form of a slightly flattened tumor surrounded by a fibrous shell filled with a whitish liquid containing calcareous concretions. It was adherent to the bone over a surface the size of a quarter and had no relation to the joint.

Roentgen examination had shown a tumor opaque to the rays on the posteroexternal surface of the humerus just above the tip of the olecranon. The tumor had a lobulated appearance due to the deposition of calcium salts. The underlying bone was only slightly changed. The patient was seen 2½ months after the operation and was clinically cured. Roentgen examination, however, showed a periosteal proliferation at the place where the tumor had been in contact with the bone.

It required operation to make a definite differential diagnosis between calcareous bursitis and capsular chondromatosis. This is the first case of subtricipital bursitis that has been described.—*Audrey G. Morgan.*

Laquerrière, A., and Lehmann, Robert. L'apophyse styloïde du cubitus: sa forme, ses anomalies, ses fractures et l'os triangulaire du carpe. (The styloid process of the ulna, its form, anomalies, fractures and the triangular bone of the wrist.) *J. de radiol. et d'électrol.*, April, 1931, *15*, 177–181.

The authors examined 1,200 plates of the wrist for the normal and pathologic appearance of the styloid process of the ulna. In more than half, a textbook picture was present, while in the others there was an anomaly varying from individual to individual and in 96 there was evidence of fracture. The chief forms of anomaly were: (1) mal-origin, the styloid process originating from the inferior surface of the ulna instead of from the internal border as usual; (2) notching of the lower end of the ulna due to exaggeration of the fossa of the internal surface, the styloid process originating from the upper part of this fossa; (3) extremely small styloid process giving the impression of a small tubercle and (4) hypertrophy either in length or width with occasional lateral incurvation. The chief forms of fractures were: (A) recent trauma, 65 cases, including all types of fractures (simple, multiple, longitudinal, transverse, fractures with wide displacement, etc.); (B) association of old lesions (large, deformed, irregular, small or free styloid process) with recent lesions (apparent serrated fracture), 2 cases; (C) simple deformities (hypertrophy, irregularity of the styloid process) of apparently long duration, 3 cases; (D) ununited old fractures with occasional pseudo-articulation, 17 cases; (E) supernumerary bone (triangular bone of wrist), 7 cases. It must be mentioned, however, that in this latter the picture was not entirely clear cut so that only a tentative diagnosis of supernumerary bone (which is exceedingly rare) could be made.—*T. Leucutia.*

Renander, Axel. Knochenmetastasen bei einem Fall von Osteoarthropathie hypertrophiante pneumique. (Bone metastases in a case of hypertrophic pneumonic oseoarthropathy.) *Acta radiol.*, Feb. 14, 1931, *12*, 29–40.

A man, aged forty-eight, came to the hospital for roentgen examination of the lungs and extremities. At the end of 1929 he began to have pain in several joints, first the left, then the right knee joint, and the wrist and ankle joints. Roentgen examination showed periosteal deposits on the femurs, humeri, radius and ulna and the epiphyses of all the metacarpal bones. These were stratified and could easily be differentiated from the normal bone beneath them. In some of these deposits there were large areas of rarefaction.

Hypertrophic pneumonic osteoarthropathy was thought by Pierre Marie to be due to chronic lung disease, particularly bronchiectases. He thought that the toxins of the broken down foci in the lung irritated the periosteum and caused the deposits. But it has frequently been found since in many other conditions, and hypertrophic pneumonic osteoarthropathy is not a good name for it because it is not necessarily caused by lung disease and because in many of the cases the joints are not involved.

The roentgen diagnosis in this case was not difficult. The patient died of cachexia about two months after his admission to the hospital. The autopsy showed tuberculosis with bronchiectases and a malignant adenoma of the suprarenals, with metastases in the already dis-

seased bones and in the lungs. These bone metastases were unusual in that they were localized in the compact bone and in the periosteal deposits and not in the bone marrow. The author thinks this must have been due to the abnormal vascularization brought about in the periosteum by the inflammation which created favorable conditions for the growth of tumor cells. The increased function of the periosteum brought about by the inflammation probably prevented the spread of these bone foci and kept them from becoming destructive and not merely expansive.—*Audrey G. Morgan.*

Sinistrero, Cesare. Contributo allo studio della lombalizzazione della prima vertebra sacrale. (Lumbarization of the first sacral vertebra.) *Radiol. med.*, Feb., 1931, *18*, 202–214.

The author describes two cases of lumbarization of the first sacral vertebra, an anomaly that may easily be confused with the opposite condition, that is, sacralization of the fifth lumbar vertebra. Both the patients had pain in the lumbosacral region with more or less diffuse radiation to one or both buttocks and the limbs. Roentgen examination in both cases showed asymmetrical lumbarization of the first sacral vertebra. The pain in these cases seems to be due to inflammation and irritation in the irregular joints rather than to compression or traction on the nerve roots. It is impossible to differentiate between lumbarization of the first sacral and sacralization of the fifth lumbar by examination of the affected metameres alone. The whole spinal column must be examined and the vertebrae counted in order to settle the question.—*Audrey G. Morgan.*

Gräberger, Gösta. Beitrag zur Kenntnis der aksessorischen Knochenkerne in den Querfortsätzen der Brustwirbelsaule sowie über die Persistenz solcher Kerne in den Querfortstäzen des ersten Brustwirbels. (Accessory centers of ossification in the dorsal spinal column and persistence of such centers in the transverse processes of the first dorsal vertebra.) *Acta radiol.*, Feb. 14, 1931, *12*, 77–84.

There are three chief centers of ossification in each vertebra: one in the body and one in each half of the arch. In addition to these, there may be a number of accessory centers, in the epiphyses of the bodies and in the tips of the spinous processes and transverse processes. In a material of about 200 subjects from ten to twenty years old, the author found that the accessory centers in the transverse processes generally make their appearance when the individual is from eleven to fourteen years old and that the fusion seems to be complete when he is from eighteen to twenty years old. In some cases, he found that the accessory epiphyseal center in the transverse processes of the first dorsal vertebra continued to exist and did not fuse with the process. They generally have a joint-like connection with the transverse process. In a material of 3000 subjects above the age of 20, this persistence in one of the processes, or both, was found in 22 cases, or 0.7 per cent; it was bilateral in 7 cases, on the right side only in 9 and on the left side only in 6. The author thinks this condition is due to the combined influence of several mechanical factors and possibly also to vascular and muscle anomalies. There is no subjective disturbance due to the perisistence of these accessory centers and no nerve or muscle symptoms caused by them.—*Audrey G. Morgan.*

Mitchell, Edward C., and Nelson, Martha V. Growth of bone and development of rickets. *J. Am. M. Ass.*, Dec. 20, 1930, *95*, 1896–1899.

Seventy individuals from private and institutional practice were studied at intervals during the first year of life with respect to growth of bone and signs of rickets. Seventy-nine per cent showed deviations from accepted normal standards. Of slow-growing infants 52 per cent showed irregular development and of rapidly growing infants 94 per cent showed changes frequently called rachitic. Only 2 infants of the entire series had a blood phosphorus below normal range. The question is raised as to whether our criteria for the diagnosis of rickets in infants are correct or whether the large percentage of changes is due to inadequacy of the usual methods of prevention.—*E. W. Hall.*

Satta, Francesco. Carie perforante dell'osso iliaco con deflusso transparietale di ascesso intrapelvico nella regione glutea. (Perforating caries of the iliac bone with discharge of an intrapelvic abscess into the gluteal region.) *Radio. med.*, Oct., 1930, *17*, 1179–1183.

Primary tuberculosis of the iliac bone is rare. In the majority of cases it is secondary to adjacent bone and joint lesions. The author describes two cases of primary localization of tuberculosis in the iliac fossa. The ilium was

perforated in each case by a punched-out ulceration or erosion with cold abscess in the pelvis and in the internal iliac fossa beneath the iliac muscle, which discharged through a pathological fistula into the gluteal region.—*Audrey G. Morgan.*

Miller, O. L. Acute transient epiphysitis of the hip joint. *J. Am. M. Ass.*, Feb. 21, 1931, *96*, 575–579.

Acute transient epiphysitis is a common cause of pain in the hips of children. It is distinguished from acute septic epiphysitis by its lesser symptoms, lack of severe illness and limited bone change. The prognosis is excellent if the cause, usually septic tonsils, is removed.

Roentgenographically there is noted a slight but constant disturbance in bone structure of the femoral neck near the epiphyseal line. The amount of change varies with the severity of the disease. Serial study at intervals of a few days is indicated.

Treatment consists of rest in bed, traction to overcome spasm and deformity and removal of foci.—*E. W. Hall.*

Muresanu, E. Fractura transversală a sacrului. (Transverse fracture of the sacrum.) *Cluj. med.*, May, 1931, *12*, 280–283.

Guillot, as reported in a recent article, was able to collect only 40 cases of fracture of the sacrum from the literature; it must therefore be assumed that the condition is quite rare.

The author observed a transverse fracture of the sacrum which occurred in a man twenty-three years of age following a direct injury to the sacral region. The case is described in detail. The interesting points are that the fracture, which extended transversely between the lower points of the alae of the sacrum, was associated with a fracture of the body of the first lumbar vertebra and that there was a urinary retention which later, following faradization, entirely disappeared. It was thought that this latter was due to temporary inhibition of the nerves produced by the compression of the hematoma around the fracture. With absorption of the hematoma and stimulation of the nerves by the faradic current a re-establishment of the proper function resulted.—*T. Leucutia.*

Kopstein, G. Zur Klinik und Röntgendiagnose der Patellartuberkulose. (On the clinical and roentgen diagnosis of tuberculosis of the patella.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, April, 1931, *43*, 476–494.

Tuberculosis of the patella is quite rare, although some of the older statistics give a high incidence.

After a discussion of the anatomopathologic appearance the author describes 4 personal cases. The following clinical signs are considered of importance: the presence of prepatellar busitis; sensitivity to pressure; enlargement and thickening of the patella, especially in case of mixed infection; irregularity of the bone surface; effusion in the knee joint (nonspecific irritative hydrops) and occasional elevation of temperature. Roentgenologically, the diagnosis is based on the demonstration of foci of increased transparency (due to granulation, caseation, necrosis, etc.) and on the secondary demineralization of the adjacent bones. This latter often forms one of the earliest symptoms. The roentgen examination must always include a film taken in the axial direction.

The differential diagnosis includes osteomyelitis, lues, tumor metastases, primary sarcoma of the patella and rarer affections such as Sven Johannsen's or Sinding-Larsen's disease (a condition similar to Osgood-Schlatter's disease in the tibia), etc.—*T. Leucutia.*

Berkheiser, E. J., and Seidler, Ferdinand. Nontraumatic dislocations of the atlanto-axial joint. *J. Am. M. Ass.*, Feb. 14, 1931, *96*, 517–523.

Five cases of nontraumatic dislocation of the atlanto-axial joint, the result of infection, with softening and destruction of supporting soft tissue, are reported. One case was bilateral, 4 unilateral and equally divided between anterior and posterior dislocations. Torticollis, limitation of motion, and pain are clinical manifestations.

Roentgenographically there is noted a rotation of the bones and anterior or posterior displacement of the odontoid with respect to the atlas. In unilateral cases there is diminution or absence of joint space on the affected side, with increased width on the opposite side. Roentgenography is difficult and requires extreme care. The condition is too frequently undiagnosed due to the poor quality of roentgenograms obtained.

Treatment consists of reduction by traction or manipulation and fixation over a variable period of time.—*E. W. Hall.*

Satta, F. Artrite leprosa o tubercolare? (Leprous or tuberculous arthritis?) *Radiol. med.*, Dec., 1930, *17*, 1395–1398.

A patient came for treatment of a lesion of the right foot which he had had for about two years. It had begun with local pain, which had increased progressively, and with difficulty in walking. The patient's face was covered with nodules which proved on examination to be those of florid tuberculous leprosy. Roentgen examination showed intense and diffuse calcification of the subastragaloid joint and an osteophyte on the posterior angle of the astragalus. The author discusses the question of whether this rarefying and proliferating osteoarthritis was a part of the leprosy or tuberculous process. He concludes that it was probably a bone localization of the leprosy, though that is rare.—*Audrey G. Morgan.*

Blaine, Edward S. Lunate osteomalacia. *J. Am. M. Ass.*, Feb. 14, 1931, *96*, 492–495.

Lunate osteomalacia, "Kienböck's disease", is a deformity of the semilunar bone of the wrist. Some authorities believe it the result of trauma and similar in etiology and course to Kümmell's disease of the spine. Others believe it of nontraumatic origin, with fracture an incident late in the course of the disease. Many cases have been reported which give no history of severe injury. Injury may be repeated as in occupational disease or due to a severe sudden force. The softening of the bone is considered by some to be due to interference with blood supply.

In cases not induced by severe trauma pain is slight at first, then absent for a variable period and finally returns in marked degree. Disability is great and long continued. Treatment, even by removal, gives indifferent results, though symptoms usually subside eventually. *E. W. Hall.*

Weiss, Konrad. Zur Pathogenese der aseptischen Nekrosen (lokalen Malazien) des Skelettes. Ein röntgenologischer Beitrag. (On the pathogenesis of aseptic necroses (local malacias) of the skeleton. A roentgenologic contribution.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, April, 1931, *43*, 442–459.

The author studied, on the basis of the roentgenologic appearance of several personal cases, the pathogenesis of aseptic necroses of the skeleton (Perthes' disease, Köhler's metatarsal disease, Kienböck's malacia of the semilunar, etc.).

The opinion is expressed that aseptic necroses are the result of a disturbance of the normal balance existing between the static structure of the skeleton and the strain to which it is subjected. This latter may be caused by one single trauma or by repeated slight injuries (chronic or occupational trauma). The static structure of the skeleton may be influenced by various anatomic and biologic factors which determine the site of localization, as, for example, local predilection in the arch of the foot, knee joint, hip joint, spine, etc.

The author does not believe that a local pathologic process (infection, embolism, rickets, etc.) has any etiologic importance in aseptic necroses of the skeleton.—*T. Leucutia.*

Temel, Tarik. Un cas rare de fibrosarcome osseux. (A rare case of fibrosarcoma of bone.) *J. de radiol. et d'électrol.*, Feb., 1931, *15*, 94–95.

This is a brief case report (illustrated with three roentgenograms) of a fibrosarcoma of the upper third of the tibia which occurred in a man sixty-five years of age, thirty years following a trauma. The administration of roentgen therapy failed to produce any improvement. An amputation a few months later led to cure, no recurrence or metastases having been observed after eleven months.—*T. Leucutia.*

Joly, Marcel. Lesions osseuses lymphogranulomateuses. (Osseous lymphogranulomatous lesions.) *Bull. et mém. Soc. de radiol. méd. de France*, Feb., 1931, *19*, 45–47.

Three cases of Hodgkin's disease with involvement of the bones (tibia, vertebrae, rib and femur) are briefly described and the following conclusions drawn: (1) the bony lesions of Hodgkin's disease may be of the osteoblastic type although most commonly they are osteoclastic; (2) they may be localized to the diaphyses of the long bones, although the short bones with spongious tissue form their seat of predilection, and (3) roentgen therapy may lead to disappearance of the clinical symptoms through arrest and fixation of the lesion rather than through regression and recalcification.—*T. Leucutia.*

Camplani, Mario. Contributo alla conoscenza radiologica delle alterazioni scheletriche del mieloma a tipo plasmo citario. (Roentgen study of the skeletal changes in plasma-cell

myeloma) *Radiol. med.*, Apr., 1931, *18*, 434–449.

There has been a great deal of discussion as to whether plasma-cell myeloma is a true tumor or a systemic disease of the blood and lymphatic systems. The author describes a case in a peasant fifty-seven years of age who began to have difficulty in respiration about five years ago, together with vague pain in the shoulder and left foot. In 1923 he was sent to the hospital for a lesion of the tonsil and a diagnosis of sarcoma was made from an examination of an excised piece of the growth. It was removed. In 1925 his nasal cavity was curetted for occlusion. In 1929 he was again sent to the hospital for roentgen treatment of the tumor of the tonsil. A diagnosis of plasmacytoma was made at that time The author at that time made a roentgen examination which showed changes in the metacarpals, one of the bones of the tarsus on one side, the skull, both clavicles and the olecranons on both sides. The roentgen pictures at first showed small clear foci from demineralization. As they progressed they coalesced and caused enlargement of the bones with a cystoid appearance. A piece was excised from the right clavicle and examined. It showed the histological picture of plasma-cell myeloma.

In this case, in view of the fact that the patient has a plasmacytoma of the tonsil with a chronic course in addition to the bone myelomas, the author thinks the tumors may be malignant, though there were no absolute anatomical signs of malignancy. The later course of the disease will show whether this assumption is correct. It is questionable whether nasopharyngeal plasmacytoma is an independent disease or only a part of a general disease due to disturbed function of the blood and lymphatic systems. Roentgen examination of the skeleton in such cases will help to settle the question.—*Audrey G. Morgan.*

Schwartz, G., and Nadaud, P. Ostéite condensante à étiologie inconnue et à localisations multiples. (Osteitis condensans of unknown etiology and of multiple localizations.) *J. de radiol. et d'électrol.*, April, 1931, *15*, 187–189.

This is a very brief case report illustrated with three roentgenograms of a man sixty-four years of age, who on examination presented a condensing osteitis of the entire spine and of the bones of the skull. The aspect in the spine was that of ivory vertebrae. No attempt was made to classify the lesion.—*T. Leucutia.*

Mesz, N., Fliederbaum, J., and Markuszewiez, R. Zwei Fälle von Achondroplasie. (Two cases of achondroplasia.) *Acta radiol.*, Feb. 14, 1931, *12*, 59–76.

The authors describe in detail two cases of achondroplasia, one of which showed the characteristic central changes (rhizomelic achondroplasia), the other the equally characteristic peripheral ones. The first case showed a hereditary familial taint. The authors emphasize the pathogenesis of the disease particularly. They give an exhaustive review of the literature of the subject and present their own theory which is that the disease is caused solely by disturbance of the function of the hypophysis. They base their opinion partly on the results of experiments made by others in removing the hypophysis from young animals but chiefly on the fact that in their cases, roentgen examination showed complete absence of the sella turcica in one and small size and deformity of it in the other.—*Audrey G. Morgan.*

Foa, A. Sur un cas d'éxostoses multiples et enchondromes. (On a case of multiple exostoses and endochondroma.) *J. de radiol. et d'électrol.*, May, 1931, *15*, 241–246.

A case of multiple exostoses was observed in a boy aged twelve, a similar condition having occurred in the father. The case is described in detail and illustrated with several roentgenograms. The chief characteristics were: (1) evidence of multiple cartilaginous exostoses at the site of the metaphyses; (2) direct, positive heredity; (3) Pre-eminent involvement of the metaphyses showing most active bony growth; (4) presence of oval zones of rarefaction such as observed in multiple endochondroma; (5) pseudo-Madelung formation of the diaphysis of the right radius, and (6) marked exostoses of the pelvic bones with involvement of the fifth lumbar vertebra.—*T. Leucutia.*

Arlabosse, J. Un cas de fragilité osseuse avec crane à rebord et sclérotiques bleues. (A case of osseous fragility with cranial deformity and blue sclerae.) *J. de radiol. et d'électrol.*, Feb., 1931, *15*, 92–93.

Apert, in 1928, called attention to a heredofamilial condition, the chief characteristics of which were: osseous fragility; deformity of the skull; laxity of the ligaments; blue sclerae; au di-

tory disorders and impairment of the electric contractility of the muscles. Since that time several similar cases were recorded in the literature.

The author recently observed in a boy nineteen years of age a marked roentgen permeability of the entire skeleton concomitant with deformity of the skull and with the presence of blue sclerae. It is interesting, however, that there were no fractures such as observed in fragility of the bones (the patient indulging in quite active sports such as football) and the auditory disorders, as well as the heredofamilial nature, were also absent. The case is placed in the group of osteopsathyrosis (fragility of the bones).—*T. Leucutia.*

BLOOD AND LYMPH SYSTEM

dos Santos, Reynaldo, Lamas, C., and Caldas, P. Les récents progrès dans la technique de l'artériographie de l'aorte abdominale. (Recent progress in the technique of arteriography of the abdominal aorta.) *Presse méd.*, April 18, 1931, *39*, 574–577.

In a previous communication before the Surgical Society of Paris in April, 1929 (*Bull. Soc. Chir. Paris*, *55*, No. 40) the authors reported their technique of procedure in abdominal aortography. The essential points of the method were: (1) puncture of the aorta by the dorsal route at the level of the 12th thoracic or 1st lumbar segment by generally following the path of splanchnic anesthesia on the left side; (2) rapid injection of an aqueous solution of sodium iodide (100 per cent strength) under uniform pressure; (3) roentgenography of the abdomen during the actual injection. To insure greater concentration of the sodium iodide within the abdominal branches of the aorta, both thighs were ligated with tourniquets.

The application since then in more than 100 cases has proved that the method is entirely harmless and well tolerated. In several instances, however, the injection of sodium iodide has produced marked pain, this inducing the authors to perform the injection under general or spinal anesthesia.

More recently three modifications were made to simplify the method: (1) the sodium iodide was replaced by abrodil (this being less toxic); (2) the general or spinal anesthesia was changed to splanchnic anesthesia, and (3) arrangement was made to take stereoroentgenograms.

(1) The abrodil is injected in doses of 20 gm. under 2 kilogram pressure (20 to 25 c.c. of a 90 per cent solution). The roentgenograms so obtained are of much better quality than those made with sodium iodide. The method, at the same time, permits the exploration of the kidney, first during the actual injection by visualization of the arterial circulation (secretory function) and second, after several minutes, by demonstration of the elimination of the abrodil (excretory function).

(2) The splanchnic anesthesia is made on the left side with a single puncture by following the usual technique, 30 c.c. of 0.5 per cent novocaine being injected in the periaortic region. After five mintues, the same needle is pushed a little further in, into the aorta, and the abrodil is injected.

(3) Stereoroentgenograms are taken during the latter part of the injection, an automatic arrangement being made for the change of tube and films.

Briefly, the present technique of procedure is as follows:

(1) Splanchnic anesthesia and puncture of the aorta. A needle 12 cm. long and of 1.2 mm. caliber (Gentile) is used, pantopon or morphine being administered five minutes previous to the injection. The patient is placed in the ventral position and tourniquets are applied high up on the thighs. The needle is inserted four fingers to the left of the midline under the twelfth rib and paralleling it, the point being directed toward the anterior part of the vertebral body (12th dorsal or 1st lumbar segment). As soon as the bone is reached the needle is slightly withdrawn and directed a little more anteriorly into the prevertebral space (a depth of 10 to 11 cm.). The novocaine is then injected and five minutes later the needle is pushed a little farther in, entering the aorta. This is recognized by the appearance of rhythmic spurting of blood, which, as a rule, is not as violent as one would expect.

(2) Injection of the opaque solution. The abrodil (or more recently a mixture of abrodil and sodium iodide) is placed in a specially constructed apparatus (Gentile) and a pressure of 2 kilograms established. At this moment, everything being in readiness for roentgenography, the rubber tube of the apparatus is attached to the needle, the patient is asked to stop breathing and the solution is rapidly injected (at the rate of 5 c.c. per second). After the administration of 15 c.c. the roentgenograms are taken without interruption of the injection. After completion of the procedure, the needle is quickly withdrawn.

(3) Roentgenography. Roentgenograms are taken with 0.8 second exposure by using the Potter-Bucky diaphragm. Should pyelograms be desired, films of the kidney are made ten to fifteen minutes after the injection.

The conclusion is reached that aortography, due to its simplicity, accuracy and safety, will form one of the most important methods in the diagnosis of certain abdominal conditions.—*T. Leucutia.*

ROENTGEN AND RADIUM THERAPY

Tracy, F. E., and Mandeville, F. B. Roentgen therapy of medulloblastoma cerebelli. *Radiology*, Aug., 1931, *17*, 259–264.

Medulloblastomas are usually centrally placed cerebellar tumors arising in the region of the roof of the fourth ventricle and occur mainly in children. They are so common in pre-adolescence that when a child has unexplained vomiting, shows a possible enlargement of the head, and gives a story of periodical unsteadiness, it is well to be on guard and look at the eye grounds frequently. A suboccipital decompression should always precede roentgen therapy, and the beneficial effects vary tremendously in duration.

The advisability of suboccipital decompression alone, or, in addition, partial or total extirpation of the tumor, is a surgical and not a radiological problem in each individual case. Thorough deep roentgen therapy over the entire cerebrospinal system should follow operation. A minimum total depth dosage of 100 per cent S.E.D. to all parts of the cerebrospinal system is indicated.

After the first complete cycle of roentgen therapy, the saturation method or a complete repetition of the cycle, two, three, or four times may be indicated during the first twelve months according to the individual case. The radiologist should exercise great caution in attempting to continue the roentgen therapy for too long a period, as the tumor cells probably become radioresistant and further radiation may damage surrounding tissues and adjacent organs.—*J. D. Camp.*

Heinismann, J. I., and Czerny, L. I. Zur Frage nach der Röntgentherapie der Gehirntumoren. (Roentgen therapy of brain tumors.) *Strahlentherapie*, 1931, *40*, 302–332.

Histories of a number of cases of brain tumor treated by roentgen rays are given. The authors believe from their experience that gliomas, which a number of authors report as very sensitive to roentgen rays, do not react extremely well to irradiation and that roentgen treatment without previous operation is not indicated. Deep roentgen therapy is indicated only in cases of afibrillary glioma and only as prophylactic postoperative treatment or as an attempt with uncertain prognosis in inoperable cases.

Inoperable malignant brain tumors, both primary and metastatic, often give surprisingly good primary results; the patient's life is often considerably lengthened and he is able to work. Certain good results of roentgen treatment in cases not subjected to operation are often due to the fact that the disease was really a serous meningitis and not a brain tumor. Improvement in cases in which the tumor does not show any changes caused by the rays is not due to an inhibiting action of the rays on plexus function as Marburg and Sgalitzer claim. The use of fractional doses does not always prevent an early reaction. Decompressive trephine is the only rational precautionary measure. Decompressive trephine should be performed not only for the purpose of relieving pressure but also as an exploratory operation for more careful localization of the site of the tumor and determination of its structure.—*Audrey G. Morgan.*

Speierer, Carl. Uber zehnjährige Erfahrung bei Thymusbestrahlung der Psoriasis. (Ten years' experience in irradiating the thymus in psoriasis.) *Strahlentherapie*, 1931, *40*, 272–285.

In 1920 Brock reported that he had completely cured cases of psoriasis by irradiating the thymus. The reports of different authors on the treatment since that time have been contradictory. The author reports his experience in the treatment of 50 cases, all in young individuals, in the past ten years. He used Brock's technique—in adults $\frac{1}{2}$ skin erythema dose with a filter of 3 mm. aluminum, and in children $\frac{1}{4}$ to $\frac{1}{3}$ erythema dose with 3 mm. aluminum filter and moderately hard radiation. He did not succeed in bringing about permanent cure in any of the cases. In some cases there was partial or complete cure for a time and the patients remained free of symptoms for varying intervals, never more than a year. Only the youngest patients were very much im-

proved by the treatment; with increasing age there was less and less tendency to respond. There was no difference in the response of males and females to the treatment.

In attempting to find the cause for this failure the author took roentgenograms and found that the hilus glands were enlarged in all these patients. He concludes therefore that there is an etiological connection between tuberculosis and psoriasis and that the improvement that is brought about is not due to any action on the thymus but to irradiation of the diseased bronchial glands. This is supported by the fact that the improvement is greatest in young subjects. In adults the diseased glands lie farther toward the periphery and are not affected by the rays. It is also known that psoriasis improves in the summer when the patients are exposed to the sun and the hygienic conditions are better than in winter; this is also true of tuberculosis, particularly of tuberculosis of the hilus glands.—*Audrey G. Morgan.*

Belot, J., and Ménégaux, G. Épithélioma de la parotide, opéré, récidivé et guéri depuis deux ans par la radiothérapie. (Epithelioma of the parotid recurring following operation and cured for two years after radiotherapy.) *J. de radiol. et d'électrol.*, Feb., 1931, *15*, 90–91.

This is a brief case report of an epithelioma of the parotid which was present for a period of over twenty years, the tumor growing very slowly. Following operative removal, there was recurrence within one month, the growth at this time being rather rapid. The administration of roentgen therapy (5,000 r (Solomon) over the site of the tumor, and 3,000 r over the opposite side, given in fractions of 1,000 r over a period of six weeks, with 200 kv., 1 mm. Cu and 2 mm. Al as filters) resulted in complete healing lasting now for a period of over two years.—*T. Leucutia.*

Gunsett, A. La roentgen- et la curiethérapie des cancers intrinsèques et extrinsèques du larynx. (The roentgen and curie therapy of intrinsic and extrinsic cancers of the larynx. *J. de radiol. et d'électrol.*, Mar., 1931, *15*, 113–128.

After a brief résumé of the literature dealing with radiation therapy of carcinoma of the larynx the author describes his own technique which is as follows: (*a*) roentgen therapy, two symmetric lateral fields of 150 cm.^{2} each, 200 kv., 2 mm. Cu and 3 mm. Al as filters, 3 ma., 40 cm. skin target distance, 4,500 r (Solomon) (1,630 r) measured on the surface of the skin per field, given in fractions spread over a period of seven to nine days. In a few instances the dose was increased to as high as 6,000 r per field; (*b*) curie therapy. This varied considerably in the individual cases but generally consisted of interstitial puncture of the accessible parts with external radiation by means of molds at 4 cm. distance and with 2 mm. platinum filter of the rest of the tumor.

The carcinomas treated were divided into two groups: (1) endolaryngeal, when the carcinoma did not extend above the superior border of the larynx and (2) exolaryngeal, when the carcinoma extended upward often involving the epiglottis and its neighboring tissues. The first were treated by roentgen therapy while in the second, in some roentgen and in others curie therapy was used. Of 10 carcinomas belonging to the first group, 4 remained well for a period of three years or longer. Of 24 carcinomas of the second group treated by roentgen therapy, none survived the three-year period, while of 12 treated by curie therapy three have remained well for a period of three years or longer.—*T. Leucutia.*

Lenz, Maurice, and Freid, Jacob R. Metastases to the skeleton, brain and spinal cord from cancer of the breast and the effect of radiotherapy. *Ann. Surg.*, Jan., 1931, *93*, 278–293.

The authors present a statistical study of 168 cases of carcinoma of the breast. Nearly half (81) had skeletal metastases proved by roentgen ray or autopsy.

The criteria used for clinical evidence of skeletal metastases was pain or tenderness localized in a part of a bone. The clinical diagnosis of brain and cord involvement was based upon symptoms of localized cerebral, cerebellar, brain stem or cord involvement. A clinical differentiation of extension and true metastases from carcinoma of the breast in the central nervous system is considered by the authors very difficult or impossible. Clinical diagnosis of pulmonary or pleural metastases was made on subjective symptoms and physical signs.

Sixty-eight per cent of the cases with skeletal metastases were associated with metastases to one or several of the other body systems as follows: lungs, 52 per cent; skin, 36 per cent; brain, 21 per cent; spinal cord, 16 per cent. Of the skeletal metastases, 62 per cent had

the pelvis involved, 59 per cent the spine, 54 per cent the femur, 39 per cent the ribs, 35 per cent the skull and 27 per cent the humerus. The other bones were involved less frequently.

Radiotherapy relieved pain in a great number of cases of skeletal metastases. In a few cases it produced a remarkable temporary regression and in a few cases of invasion of the central nervous system it also caused palliation. —*F. K. Alexander.*

Fuhs, H., and Konrad, Josef. Über Spätschädigungen nach Röntgenbestrahlung von Dermatoses und Folgerungen bezuglich des Bestrahlungsmodus. (Late injuries after roentgen irradiation of dermatoses and conclusions in regard to the technique of irradiation.) *Strahlentherapie*, 1931, *40*, 254–271.

Tables are given showing the results of roentgen treatment of dermatoses at both Dermatological Clinics in Vienna, special attention being given to the cases of late injury. The authors conclude that the injuries were probably caused by the method of irradiation, particularly by the use of too large doses at too short intervals. There were very few injuries in proportion to the total number of cases treated, only 33 cases of injury in a total of 9,293 cases treated. But as a result of even this small number of injuries they thought it advisable to change the technique slightly and since this change in technique they have had no further injuries. The details of the technique for the different diseases are given. The change consisted in a slight decrease of dosage with lengthening of the intervals.—*Audrey G. Morgan.*

Stevens, R. H. Skin malignancy. *Radiology*, April, 1931, *16*, 435–444.

The author holds that local cures of cancer of the skin by modern expert radiation should approach closely to 100 per cent. The great importance of biopsy for diagnosis and the selection of treatment is emphasized. Biopsies, he thinks, are perhaps more safely performed with the radio knife than with the cold knife, especially when melanomas and moles are concerned. In general, he regards radiation and electric surgery as of greater value in the treatment of cutaneous malignant growths than surgery with the cold knife.—*J. D. Camp.*

Levin, Isaac. Lymphoma malignum (Hodgkin's disease) and lymphosarcoma; pathogenesis, radiotherapy and prognosis. *J. Am. M. Ass.*, Feb. 7, 1931, *96*, 421–426.

A study of over 500 cases of these diseases leads the author to conclude that they are phases of the same pathological entity and may exist in the same patient in the same region. Inflammatory lymphadenitis may precede malignant lymphoma or lymphosarcoma. Nearly 50 per cent were early and unilateral, but all became generalized, and all nodes should be considered potentially malignant and should be treated by radiotherapy. All cases of uncertain adenopathy must be considered malignant and treated early, a procedure which will materially improve therapeutic results.—*E. W. Hall.*

Hayer, E. Schwierigkeiten bei der Strahlentherapie interner maligner Tumoren. (Difficulties in the radiotherapy of internal malignant tumors.) *Strahlentherapie*, 1931, *40*, 50–53.

A case is described in a man of fifty-five with stomach symptoms. Clinical and serological examination limited the pathological focus to a relatively small area. Tumor was finally suspected obstructing the bile ducts, but its exact localization and the extent of involvement of the regional lymph glands could not be determined. The patient was in extremely bad condition. He improved suddenly a few weeks after irradiation and was discharged free of symptoms. The cure was so remarkable that it suggested that the diagnosis of tumor was a mistaken one. But six months later he had a recurrence which progressed rapidly and he died within a few weeks. Histological examination showed a broken down carcinoma at Vater's papilla with extensive metastases in the liver and lungs.

In this case, at the beginning of irradiation the tumor was probably strictly localized, and the good results of the irradiation were probably due to the fact that it destroyed inflamed tissue around the tumor, rather than to its effect on the tumor itself. Certainly the tumor had been broken down by later irradiation, as shown by histological examination, but the cancer cells had not been entirely destroyed. This is the only way to explain the sudden recurrence and rapid generalization of the tumor. —*Audrey G. Morgan.*

Grosglik, Adam. Zur Röntgenbehandlung des Magen-Duodenalgeschwürs. (Roentgen treat-

ment of ulcer of the stomach and duodenum.) *Strahlentherapie*, 1931, *40*, 286–301.

The author reports the results of roentgen treatment of ulcer, 20 of the stomach and 11 of the duodenum. The patients had had the symptoms for from one to eighteen years. All of them had been treated for a long time internally and some of them also with protein therapy. One of them had been operated on twice. One of them also suffered from myeloid leucemia. He used hard rays (180 kv.) and heavy filtration (0.5 zinc or 0.5 copper and 4 aluminum). The dose was 75 to 100 per cent of a skin erythema dose at the surface, distributed over 5, 6 or 7 days; according to his iontometric measurements this means a deep dose of 25–30 per cent. One to three series were given with an interval of at least a month between them, sometimes several months.

There was very great improvement in the symptoms. Pain decreased greatly or disappeared entirely; in most cases it recurred but was less intense than before. The same was true of the other symptoms such as eructation, constipation, hemorrhage, loss of appetite and vomiting. This condition of freedom from symptoms lasted for from several months to a year or more. But roentgenoscopy in all the cases showed that the ulcer still persisted.

In attempting to account for this disappearance of symptoms without healing of the ulcer, the author concludes that the primary disease is a gastritis or duodenitis and that the ulcer is a secondary complication. The roentgen treatment is a treatment of the chronic inflammation and not of the ulcer itself. In cases in which the chronic inflammation is not very severe or extensive the ulcer may heal afterward. The failure of the ulcer to heal in the author's cases was probably due to the fact that they were all quite advanced. In advanced cases with sclerotic walls of the ulcer roentgen treatment is not indicated.—*Audrey G. Morgan.*

Saltzstein, Harry C., and Sandweiss, David J. Some commoner difficulties in diagnosis and treatment of carcinoma of the rectum and colon. *Ann. Surg.*, Jan., 1931, *93*, 336–347.

The authors present the results obtained from a review of 224 cancers of the rectum and colon, paying special attention to the symptomatology manifested when the lesions are located in different divisions of the colon and rectum.

With carcinoma of the rectum the first symptom was not bleeding, for this occurred in only one-third of the cases, the more common and constant findings were tenesmus, pain or discomfort in the region of the rectum. It is only after the tumor ulcerates that bleeding occurs. Diarrhea or constipation and gas were also frequently noted.

In the rectosigmoid, bleeding was the first symptom noted in one-fourth of the cases, while one-half started with symptoms of restriction or irritation. Left abdominal pain, loss of weight, and weakness were associated with the remainder of the cases.

Carcinoma of the sigmoid and descending colon usually produced lower abdominal pain and distress and obstinate constipation. Bleeding, diarrhea, bloating, loss of weight and weakness were also other symptoms. Attacks of subacute or acute obstruction were common at this location. The above symptoms were also common to cancer of the splenic flexure and transverse colon.

The early pains due to carcinoma of the hepatic flexure were not so frequently confined to the lower abdomen on the right. Obstruction was not prominent. The growth attained large proportions and it was confused with gallbladder disease. Pain in the cecal and ascending colon was chiefly confined to the right lower quadrant.

The authors report an error of 22 per cent in roentgen examinations of this series.

The treatments used were either resections, colostomy, or ileostomy, and statistical studies as to the results obtained from this form of therapy are presented.—*F. K. Alexander.*

Magnusson, W. The results of radiological treatment of cases of bone sarcoma at Radiumhemmet, Stockholm, 1910–1928, *Acta radiol.*, Apr. 15, 1931, *12*, 101–120.

The author reviews the literature on the subject and gives the results of his own work in the treatment of bone sarcoma by irradiation at the Radiumhemmet, Stockholm, from 1910 to 1928. Thirty-nine cases were treated. Only inoperable cases and cases that had been operated on with or without recurrence of symptoms were irradiated. Permanent cure was not brought about in any of the 16 cases that were treated by irradiation alone. In one case of osteogenic sarcoma that had been operated on conservatively healing was brought about for more than three years. Among the cases oper-

ated on and given radiotherapy afterward, 3 patients are alive after seven years or more with no symptoms. In 2 of these cases the sarcoma was of the osteogenic type and in one a Ewing's sarcoma.

On the basis of the reports in the literature and his own experience, the author comes to the following conclusions in regard to indications and technique:

In determining the indications for radiotherapy a distinction should be made between osteogenic and Ewing's sarcoma. The results of irradiation in osteogenic sarcomas so far do not justify giving up surgical treatment of such tumors. In operable cases a combination of irradiation and surgery should be used. Inoperable cases should be irradiated. Even in cases in which the tumor has become generalized very good palliative effects can sometimes be obtained. Ewing's sarcoma is very radiosensitive and radiotherapy alone is justified in this form of tumor.

The author does not advise the close application of radium. It is impossible to say as yet whether distant radium treatment is preferable to roentgen irradiation. Large doses—from 1 to 1.5 erythema doses—at the focus are necessary. High filtration and long focal distances are indicated. It is best to give the largest possible dose in the first series of treatments while the growth is most sensitive and the surrounding tissues are not yet affected.—*Audrey G. Morgan.*

Langeron, Desplats, Paget and Quéméré. Recherches sur les modifications de la calcémie chez l'homme après radiothérapie. (Investigations on the modifications of calcemia in man following radiotherapy.) *Bull. et mém. Soc. de radiol. méd. de France*, Feb., 1931, *19*, 70–73.

The authors carried out a series of investigations on the effect of functional roentgen therapy of the neuroglandular system upon the modifications of the calcemia (8 individuals being irradiated over the suprarenal regions and 4 over the cervical sympathetic). All tests were made with non-hemolyzed serum taken by venous puncture, the operation being carried out as quickly as possible to prevent the accumulation of calcium in asphyctic blood. The technique was that of Cristol: the disalbumination of the serum was effected with trichloracetic acid (12.5 per cent), the deproteinized serum adjusted to pH 4.5 to 5 by the addition of a few drops of sodium hydroxide, the calcium precipitated at 80° with an excess of ammonium oxalate and finally dosed by the manganimetric method. The irradiation was carried out with doses of 1,000 to 1,250 R per sitting for 4 seances given during a period of six to ten days, with 25 cm. spark gap (130,000 volts) 3 ma., 30 cm. skin target distance, 5 mm. Al filter.

The following results were obtained: (1) there was a definite action of the roentgen rays on the calcemia; (2) this action manifested itself in an immediate and considerable increase of the blood calcium; (3) twenty-four hours later the calcium still continued to increase in amount; (4) the decrease started within two to six days, reaching the normal level at a rate varying in different individuals; (5) a new increase (third phase) followed at a considerably slower rate, reaching its maximum within three to six weeks, and finally (6) irradiation of the suprarenal region provoked a more marked increase of the calcemia than the irradiation of the cervical sympathetic but in this latter the increase was of a longer duration and more pronounced at the end of the sixth week.—*T. Leucutia.*

Langeron, Desplats, Paget and Chérigié. Recherches sur les modifications de la glycémie observées chez l'homme après radiothérapie. (Investigations on the modifications of glycemia in man following radiotherapy.) *Bull. et mém. Soc. de radiol. méd. de France*, Feb., 1931, *19*, 73–76.

These investigations were carried out on individuals with normal glycemia and with hyperglycemia. Of 11 cases studied, in 7 the region of the suprarenals and in 4 the cervical sympathetic was irradiated, the dose amounting to 1000 R on the right and left sides alternately for a total of 4 seances within a period of eight days; 25 cm. spark gap, 5 mm. Al. The blood sugar was determined as follows: the serum was disalbuminated with tungstic acid and 2 c.c. of the filtrate treated with special tartarocupric solution, the cuprous oxide so obtained being subjected to the action of the phosphomolybdic reagent. Since the blue color is proportional to the amount of blood sugar, the quantity of the glucose was calculated from the volume of the permanganate necessary for the decoloration of the solution.

The following results were obtained: (1) the glycemia decreased immediately following

roentgen therapy; (2) this decrease was the more pronounced the greater the glycemia; (3) it appeared following the first and was accentuated following each subsequent seance; (4) the decrease became gradually more pronounced during weeks and even months following the treatment, this being especially marked in cases of hyperglycemia; (5) the results obtained by irradiation of the suprarenal and cervical regions were practically identical; (6) other zones irradiated (epigastric, perineal, etc.) led to similar results.

In conclusion, the authors emphasize that the above results apply only to a well-determined technique (medium penetrating rays with 5 mm. Al, medium doses) and that a few experimental irradiations in diabetics with a similar technique led to encouraging improvement of the diabetes.—*T. Leucutia.*

Anspach, Brooke M. The early diagnosis of adnexal cancer. *Am. J. Obst. & Gynec.*, Oct., 1930, *20*, 571–581.

About 232 cases of primary cancer of the fallopian tubes have been reported in the literature. Strübler and Brandess list it as forming 0.45 per cent of all genital cancers, the same rating they give for cancer of the clitoris. Strübler and Brandess note the relative frequency of location in genital carcinoma as follows: cervix, 61.27 per cent; body, 16.04 per cent; ovary, 16.85 per cent; vulva, 2.9 per cent; vagina, 1.97 per cent; tube, 0.45 per cent; clitoris, 0.45 per cent.

Prognosis is bad in cancer of the tube. The actual percentage of recovery of the patients recorded in the literature is difficult to estimate, but with operation and radiation combined, it is probably not more than 4 per cent (Beck). Adnexal cancer is rapidly disseminated. The author quotes from the reports of Byron and Berkhoff, Zweifel and Payr, Schleyer, Norris, and Strübler and Brandess on cancer of the ovary.

Anspach analyzed 28 malignant tumors of the ovary, 26 carcinomas and 2 sarcomas, and one primary cancer of the tube from the Jefferson Hospital. The symptoms are usually sufficiently severe only in the later stages of the disease to cause the patient to consult their physician. The chief symptoms are pain and bleeding. When post-climacteric bleeding and discharge continue from the uterine cavity in spite of negative curettage for evidences of uterine malignancy, especially if there is pelvic pain or the bloody discharge is periodic, one may suspect an adnexal cancer; palpable enlargement of one or both sides under such circumstances warrants an exploratory incision. The treatment of adnexal carcinoma is surgical when that is possible. The author quotes the report of Keene, Pancoast and Pendergrass upon the value of irradiation in inoperable cases or as a postoperative measure, in which they conclude that irradiation often helps in these cases but that it is impossible to predict its effect in a given case.—*J. H. Vastine.*

Weiss, Kurt. Uber die Badische Organisation der Krebsbekämpfung und ihre Einrichtungen. (The organization for fighting cancer in Baden.) *Strahlentherapie*, 1931, *41*, 11–24.

There has always been a great deal of cancer in Baden and statistics show that it is increasing. Czerny conceived the idea of a systematic fight against cancer but did not have the means for carrying it out. His efforts did lead, however, to the founding of the House of the Samaritan in Heidelberg, which has been doing good work for twenty-five years. A committee for studying and fighting cancer was also established at that time, but its resources were so limited that it could not accomplish much. But when it was found in 1927 that 1 out of 10 persons over forty years of age die of cancer, a National League for Fighting Cancer was established. They saw at once that they must have government recognition and support. When the League was finally established it included representatives of the Departments of the Interior and Education, of the majority of the political parties in the Assembly, of the medical faculties of the Universities of Heidelberg and Freiburg, of the social insurance and welfare societies and of the physicians, press and scientists of the country. The Social Insurance Society offered its equipment and services for the work.

A Scientific Committee was established for research purposes and other committees for procuring funds. An annual contribution was made by the government and other contributions by committees and individual members. The tasks undertaken were to establish centers where the poor could be given free examination, to train sisters for the care and nursing of cancer patients, to support cancer research, obtain sufficient amounts of radium for treatment, provide for the care of advanced cases of cancer in poor people and provide for in-

struction of the public in regard to early diagnosis of cancer.

Stations for examination and treatment were immediately established in connection with the hospitals in the five leading cities of the province, and a campaign of publicity inaugurated for the instruction of the public. In addition to lectures, leaflets and posters, travelling exhibits were sent out, similar on a smaller scale to those of the Dresden Hygienic Institute. There is a permanent exhibit in Karlsruhe which is visited every year by thousands of people. A house to house campaign was inaugurated to obtain money to buy radium, which was purchased and divided amoung the three leading hospitals.

Already results are beginning to appear and cases of external cancer are coming for treatment earlier. Early diagnosis of internal cancer, such as gastrointestinal cancer, which in 1929 consitituted about 72 per cent of the cancer cases in Baden, is very difficult, because these cancers do not cause symptoms until they are far advanced. In addition to clinical and roentgen examination, the Kahn albumin reaction is generally tested and is often the decisive factor in doubtful cases.

The author thinks the ideal plan would be to make systematic examinations for cancer in all individuals over forty years of age. This and the reporting of all cases by physicians would help in detecting all cancers. Provision is to be made for caring for all helpless cancer cases as long as the patients live, and placards are posted in prominent places telling the people where they can go for examination and treatment. Cancer will probably continue to increase for some time. Life is being prolonged so that more people reach the cancer age and better methods of diagnosis are revealing more cases. Fighting cancer has become a social problem in which the government, the municipalities, the sick insurance societies and all social welfare organizations should participate.—*Audrey G. Morgan.*

Tausch, M. Klinische Erfahrungen mit dem Vulvakarzinom. (Clinical experience with carcinoma of the vulva.) *Strahlentherapie*, 1931, *40*, 44–49.

Among the 41 cases of primary carcinoma of the vulva that the author has observed, 2 left the hospital untreated and of the remaining 39 nineteen were treated by operation alone, 7 by operation and after-irradiation and 14 by irradiation, 7 with roentgen rays, one with radium and 5 with roentgen rays and radium. In the roentgen cases a full carcinoma dose was given over five fields, 1 skin erythema dose over each, with a focus-skin distance of 30 cm, and a filter of 0.8 mm. copper and 1 mm. aluminum; a filter of 0.5 mm. copper and 1mm. aluminum was used over the vulva field, with a current of 220 kv. and 4 ma. For the radium treatments Dominici tubes were used with a filtration of 0.3 mm. silver and 1 mm. brass. The gamma irradiation corresponded to that of 23.1 mg. radium element.

Among the 39 women 8 were still well after more than five years which would give an absolute cure of 19.51 per cent. But 4 of these patients died later, one after $5\frac{3}{4}$ years, and the others after 7, 10 and 14 years and another died after 12 years of an intercurrent disease. This leaves only 3 cases of absolute cure, or 7.32 per cent. It is impossible to say whether this is due to special malignancy of carcinoma of the vulva or whether the five-year period usually given is not long enough.

Among 4 cases of secondary carcinoma of the vulva one patient was lost sight of, one died after $4\frac{1}{2}$ years and 2 were still alive after the end of the five-year period. One of these is still alive after $13\frac{1}{2}$ years but has had a recurrence for $3\frac{1}{2}$ years and the other died after 8 years of an intercurrent disease, diagnosed as paralysis of the bladder, but the author questions whether this was not from a late recurrence. Though the number of cases is too small for definite conclusions, he is inclined to think that cancer of the vulva is particularly malignant.—*Audrey G. Morgan.*